

# Subterranea

The Magazine for Subterranea Britannica



Subterranea Britannica



December 2017 Issue 46

IN THIS  
ISSUE

Collyweston Slate  
Dover and France Weekend

Chilmark RGHQ 7.1  
Cabinet War Rooms Visit

Subterranea Britannica is a society devoted to the study of man-made and man-used underground structures and the archaeology of the Cold War. The society is open to all and its membership includes all walks of life. Members are invited to contribute to this magazine even if this just means sending very welcome snippets from newspapers and magazines.

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**Front cover photo:** The two 147kW diesel generators at Chilmark RGHQ in Wiltshire. These would supply electrical power if the mains supply had failed. At the rear of the generator a blast door is seen. This gave direct access to the lower floor plant room for machinery etc. Photo Nick Catford

**Back page upper:** The Sub Brit group assemble at the V3 at Mimoyecques, France, approximately at the point where the original railway portal would have been. The entrance to the tunnel complex is now thirty metres in from the site of the original portal due to the demolition and subsequent re-excavation. Photo Clive Penfold

**Back page lower:** A sloping road in a cutting leads to Western Heights (Dover) north entrance; a magnificent facade with two red and cream brick arches, one containing the guardroom, the other the road through the ramparts to the bridge. Guardroom to left, tunnel to right; on the right wall a pre-tunnel entrance to the water tanks. Photo Bob Clary

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However the Editor reserves the right not to publish material without giving a reason.

The committee of Subterranea Britannica and the Editor do not necessarily agree with any views expressed and cannot always check the accuracy of any material sent in.

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# Chairman's Welcome

**Martin Dixon**

First of all, I'm delighted that we gained eighteen new members in the month of October (the last full month before copy date). This says a lot for the health of *Subterranea Britannica* and I offer all new members a very warm welcome. Just like many of the tunnels that so enchant us, I hope your membership is both long and deep.

I'm writing this fresh from our Autumn Day Meeting, where ninety members took in a great day of presentations on underground sites near and far. Congratulations to Phil Catling for creating such a rich seam of speakers. I kept a tally and the reasons for the sites' construction included:

- \* Extraction/Mining
- \* Transportation
- \* Military (Firepower and Control)
- \* Civilian Protection
- \* Concealment
- \* Artistic expression
- \* Religion

One of the few genres not featured this time round was agriculture where sites I have seen include mushroom growing, potato storage and micro herb production. I've even visited two UK sites that have been in the news recently for illegal cannabis production. That said, a former NATO bunker near Memmingen in southern Germany is set to become the home for the largest legitimate producer of cannabis in the country. Not sure if a Sub Brit tour would be possible – but as the saying goes, the grass is always greener on the other side....

Our Day Meeting was followed by a day crisscrossing the Thames through many of its tunnels. This was set up after

requests from members who wanted to make a weekend of it rather than just attend the Day Meeting. It's amazing what can be seen by just a little concentration – flood gates, disused stations and tunnelling shields, to name just a few. A high (or should that be low?) spot was our group of forty walking en masse through the Rotherhithe Tunnel (yes, perfectly legal) which caused some surprise on the faces of the many car drivers who passed us. A full report of what was a really fun day appears elsewhere in this edition of *Subterranea*.

Whilst on the Thames Tunnel tour, we could see evidence of current tunnelling activity – for example the new Elizabeth Line Canary Wharf station box and excavations for the new Thames Tideway 'super sewer'. One of the delights of studying underground space is that it grows every day as new structures are tunnelled, mined and excavated. This creates new sites for us and our successors to explore and enjoy.

The Thames Tideway project team have kindly agreed to host Sub Brit on a boat tour of some of their key sites on the afternoon of Friday 13 April (hopefully not prophetic) which is the day before our 2018 Spring Day Meeting and AGM; more details in due course.

Finally if you are shopping online this Christmas then do remember the Sub Brit online shop. As well as listing our own publications, Sub Brit earns a small commission for anything else (yes, anything) ordered from Amazon if you start at the Sub Brit site.

Festive Greetings to all, and may 2018 bring all that you wish for above and below ground.

chairman@subbrit.org.uk



*Mushroom growing at Bethel Quarry, Bradford-on-Avon, Wiltshire.  
Sub Brit visit October 1985. Photo Nick Catford*



# SUBTERRANEA BRITANNICA DIARY

## Summary of Forthcoming Events

### Sub Brit specific events

#### 2018

- 27 January SB Committee Meeting
- 5 February Mailrail Visit
- 1 March Copy deadline for *Subterranea* 47
- 13 April Thames Tideway Trip (15:00 -17:00)
- 14 April SB Spring Meeting & AGM, London
- May *Subterranea* 47 published
- May (tbc) Paddock Open Day
- 11-14 May SB Budapest Study Weekend
- 9 June SB Committee Meeting
- 1 July Copy deadline for *Subterranea* 48
- September *Subterranea* 48 published
- 22 September Paddock Open Day
- 20 October SB Autumn Meeting, Nottingham
- 21 October Visits Day, Nottingham
- 1 November Copy deadline for *Subterranea* 49
- Mid - December *Subterranea* 49 published

### Other underground-related events

#### 2018

- 6 - 9 March Conference on Caves and Karsts, Ardèche, S. France
- 21 April SERIAC Conference, Windsor
- 23 - 27 April Fortress Study Group - Alderney Study Tour
- 4 - 7 May Railway & Canal Historical Society AGM, Wrexham
- 1 - 3 June NAMHO Conference 2018, Forest of Dean
- 23 - 27 June AIA Conference, Caithness
- 6 - 9 & 13 - 16 September Heritage Open Days, England
- 22 - 23 September London Open House
- September (tbc) Heritage Open Days, Scotland, Wales & N. Ireland

#### 2019

- 20 - 26 May Hypogea, Bulgaria

For web links to these events please visit [www.subbrit.org.uk/events](http://www.subbrit.org.uk/events)  
or contact the Society concerned

*If you know of other relevant events run by other societies, please let us know  
so that they can be advertised in the next edition and on the website*



# Summary Minutes of Committee Meeting 4 November 2017 at St. Peter's Church Hall, Leicester By Sub Brit Secretary, Linda Dixon

**Attendees:** Martin Dixon, Linda Dixon, Tony Radstone, Nick Catford, Bob Templeman, Paul Sowan, Jason Hughes, Chris Gray, Phil Catling. Apologies Alistair Graham Kerr, Richard Seabrook, Tim Wellburn, Richard West.

## **Commemorating Chris Rayner**

A plaque has now been installed at Mail Rail. Thank you to Richard West for helping to arrange.

## **Health and Safety.**

This is a standing item on our Agenda. No issues to report.

## **Grants and Projects**

In recognition of Sub Brit's donation to Mail Rail, there will be 5 special tours for members over the next 3 years. Richard West is arranging these. As they are expected to be popular, people will request a tour and then be selected by Ballot. Other projects are being progressed.

## **Day Meetings**

The Autumn Meeting went very well – thanks to the team who put it together, especially Phil Catling, as it was his first time arranging speakers and MC-ing the day. We had nearly 90 attendees with a good number of 'walk-ins', but a disappointing number of no-shows. Spring Meeting planning is underway for 14 April at the Royal School of Mines, London. The Autumn Meeting in 2018 will be in Nottingham on 20 October, followed by a day of visits on Sunday 21st.

## **Visits/Trips**

The Gibraltar trips arranged and hosted by Tim Wellburn and Clive Penfold in October went very well. We had a surprisingly low number of attendees on the 2nd trip. Alistair Graham-Kerr set up the long weekend in Portsmouth/IOW which was also well attended. Chris Gray has proposed a weekend trip to Budapest in May 2018 – early planning is underway with Tony, Martin & Linda. Other ideas for overseas and UK weekends welcomed.

## **Day Visits/Trips**

We have had a good number of recent trips and there are more in the planning – they will be announced to members by email, or in *Subterranea* if there is time. Bookings for trips with limited numbers which require payment will be by Paypal (generally non-refundable). If members have suggestions or can run trips, then please get in touch.

## **Officers' Reports**

The Committee agreed to leave subscriptions at their current rates, as the bank balance is healthy. We are still keen to see further progress to update the SB website. Mike Moore agreed to represent Sub Brit at the NAMHO meeting today – thank you.

## **Sub Brit 'Flyer'**

We are getting near the end of the stock of the current version – Linda volunteered to revise and get more produced as they are useful for events and publicity.

## **Membership cards**

There has been debate on the Forum about this. The Committee agreed that they did not wish to provide Membership cards and there was a risk they would be used incorrectly. A letter on official paper can be provided to any member trying to arrange a site visit.

## Sub Brit Shop

The society sells previous issues of *Subterranea* magazine and other publications through the Sub Brit website.

Recently, some older issues of *Subterranea* have been out of stock, but we are pleased to say that a secret supply has been unearthed (thank you Nick!) and these are now available for purchase.

To look at what's available, go into the 'Shop' tab on the top line of the website, select 'Publications' and then 'Subterranea'. You can then search for the name of the site you may be interested using the 'Search for products' box on the top right-hand side of the screen.

A comprehensive Index of all sites that have been featured in back numbers of the magazine was enclosed with Issue 41. If you need an extra copy, then please contact us and we can send another.



# NEWS

Miscellany compiled by Paul Sowan and Nick Catford

## NEWS – ARCHAEOLOGY

### England's 'Cave men'

During the coldest phases of the last Ice Age, most of what is now England lay below glacial ice sheets, and our territory was linked by what emerged (after the ice had melted) as 'Doggerland'. The southern and Home Counties areas were inhospitable arctic desert. The 'Ice Age' was not a single period of intense cold, but of climatic variation, with cold and warmer periods alternating, the ice retreating and advancing by turns.

During the warmer periods vegetation, the larger wild animals, and the first human beings reached our land by way of the then land connections from mainland Europe. During the cold phases, those advances were reversed. One school of thought has it that we are, at present, still in a further warm period in the Ice Age, raising the possibility of glaciers extending south to the Chiltern Hills yet again!

The first (Palaeolithic) human beings, sometimes referred to as the 'Cave men', reached what is now England around 15,000 years ago. Most of what little we know about them is the result of their bones, the bones of the animals they hunted for food, and their primitive stone tools having been found by archaeologists in caves, especially those near Torquay, in Cheddar Gorge, and at Cresswell Crags on the Derbyshire / Nottinghamshire border. Of course, most of their lives, the so-called 'cave men' were hunting all over England, nowhere near any caves in which they could shelter. It just happens that cave environments have secured the preservation of evidence which has otherwise mostly been scattered and destroyed. An article by Nick Ashton outlines the evidence for the earliest waves of immigration from mainland Europe, and includes such interesting facts as that all over England were found stone implements made of flint from southern and eastern England, and that there is clear evidence from butchered and tooth-marked human bones that cannibalism was practised. Nick Ashton is the author of a newly published *New Naturalist* volume on these early humans. SOURCES: ASHTON, Nick, 2017, Early ancestors: meeting the humans who inhabited Britain 15,000 to 11,000 years ago. *Current Archaeology* 28(330), 20 – 21, and AHSTON, Nick, 2017, *Early humans*. Harper Collins / Collins New Naturalist 134: xi + 354 + (2)pp [ISBN 9780-00-815033-4]

### Hidden chamber is found in the Great Pyramid of Giza

A long-hidden narrow void in Egypt's Great Pyramid of Giza has been found by scientists in a discovery that could finally reveal the secrets of the 4,500-year-old monument. The void stretches for at least 30 metres above the Grand Gallery – an ascending corridor that links the Queen's

Chamber to the King's in the heart of the pyramid. It is not known why the void exists or if there are any valuable artefacts inside as it is not obviously accessible. But it has similar dimensions to the gallery, which is 50 metres long, eight metres high and around a metre wide. Researchers suggest it could be a 'construction gap' – part of a trench that allowed workers to access the Grand Gallery and King's Chamber while the rest of the pyramid was built. The discovery was made after physicists took images of the inside of the pyramid using particles fired to Earth from space. These cosmic particles penetrate the rock in a similar way to X-rays, only much deeper. The collaborative effort, between archaeologists, historians and physicists, has been hailed as the biggest discovery inside the Giza landmark since the nineteenth century.

SOURCE: *Daily Mail*, 3 November 2017.

### Witch marks in Wookey Hole, Somerset

Seven scratched marks on the wall in Wookey Hole Caves have been interpreted as 'witch marks' dating from around 400 years ago. What at first sight is a 'W' is thought to be two letter Vs overlapping, and standing for 'Virgo virginum' or 'Virgin of virgins', the Biblical mother of Jesus.



*Many of the marks are believed to be a double V and are a reference to the Virgin Mary*

Such signs are known in other contexts, underground and in buildings, and are believed to be the work of people who sought protection from witchcraft. Belief in and fear of witchcraft was common throughout Europe during the period 1550 to 1750, with trials of suspected witches peaking between 1580 and 1630.



The marks are therefore believed to differ from random graffiti. The marks will now become a stopping point in guided public tours of the caves. See also: [www.wookey.co.uk](http://www.wookey.co.uk)

SOURCE: ANON, 2017, Wookey Hole's witch marks revealed. *Current Archaeology* 28(5)(329), page 12.

### Visiting the Rhydymwyn tunnels, Flintshire

A long-held secret site at Rhydymwyn near Mold in the North Wales county of Flintshire can now be visited on guided public tours organised by the Rhydymwyn Valley History Society <http://rhydymwynvalleyhistory.co.uk>. The secret site dates from 1938 when 94,000 sq ft of underground storage space was created in which to keep 3,000 tons of British-made mustard gas, for use in the event of German troops invading England.

Between 1941 and 1945 some 28,000 tons of Runcol, an even more deadly chemical weapon, were manufactured here. Also, between 1942 and 1945 Building 45 (now Listed) was the scene of experimental work connected with British work on nuclear weapons. From 1958 to 1969, after poison gas stock was removed and/or destroyed, the tunnels were used to store the Bank of England's gold.



The Society was formed in 2008 to further historical research and to negotiate access to the site. Access was gained in May 2016, and guided public tours are now possible on a few dates each year. The number and size of tours is limited by the availability of guides, who undergo historical and safety training before conducting visitors around the site and underground.

SOURCE: Rhydymwyn Valley History Society, 2017. *Current Archaeology* 28(5)(329), page 66.

### Cannibal cave men at Cheddar Caves, Somerset

Sometime inhabitants living in Gough's Cave at Cheddar between 12,000 and 17,000 years ago have previously been found to have been cannibals. Recently the bones of at least six individuals have been interpreted as further evidence. They were a three-year-old child, two teenagers, and three adults. The bones bear clear marks of butchery and human tooth-marks.

Detailed study of the marks suggests that the finds reflect something more than the satisfaction of hunger, as some

marks suggest deliberate ornamentation as well as the disengagement of edible flesh. A full research report can be found at <http://doi.org/10.1371/journal.pone.0182127>  
SOURCE: ANON, 2017, More evidence of ritual cannibalism at Gough's Cave. *Current Archaeology* 28(7) (331), page 9.

### Unexpected discovery of crypt and remains of Archbishops of Canterbury at former St Mary's Church, Lambeth

St. Mary's Church in Lambeth has, since its deconsecration, been converted as the Museum of Garden History. It stands next to the Archbishop of Canterbury's Lambeth Palace. Apart from the tower, little of the original church remains above ground, the main part having been demolished and rebuilt in the nineteenth century.

Work for the Museum has revealed a hitherto unsuspected crypt below the chancel containing an estimated 20 to 30 lead coffins. On health and safety grounds, archaeologists elected not to enter the crypt by way of a very narrow aperture, but were able to record photographically what data could be captured by a camera fixed to the end of a pole. The crypt is built of brick, measures about three metres by six metres, and has a vaulted ceiling. Some of the occupants have been identified from such name plates on the coffins as could be recorded.



*A red and gold mitre sits on the pile of coffins at the Garden Museum*

One is occupied by the remains of Catherine Moore, the wife of John Moore who was Archbishop from 1783 to 1805. An archbishop's 'burial mitre' was also found. As it has been recorded that seven archbishops altogether were buried somewhere at this church, inside or outside, the bones of some at least are in the crypt, either their last resting place or possibly relocated from other places in the church or in the churchyard.

SOURCE: WHITE, Steve, 2017, Under the chancel: discovering a 'hidden' crypt in Lambeth church. *Current Archaeology* 28(330), 36–41.

### Evidence for the resurrection men in London

Excavation of the 'New Churchyard' on the site of the Crossrail station at Liverpool Street has revealed evidence of measures taken to prevent the theft of recently buried

persons. So-called ‘body snatchers’ or ‘resurrection men’ would sell the fresh corpses to medical men, as surgeons needed human bodies to dissect as a part of their training. The supply of bodies of executed criminals, the only legal source at the time, was insufficient to meet demand. The new non-parochial graveyard was established in 1569, as many churchyards were overcrowded. By the time the graveyard closed in 1739 it contained some 25,000 burials. Recent archaeological excavation has led to the discovery of a skeleton in an otherwise sand-filled coffin, on the lid of which a number of large, heavy stones had been placed. The find has been interpreted as a measure taken to deter theft of the body.

SOURCE: ANON, 2017, Beating London’s body snatchers. *Current Archaeology* 28(7)(331), page 13.

## NEWS – CONSERVATION AND HERITAGE

### 70th anniversary of Listed Buildings

The United Kingdom has a rather untidy system of statutorily protected ‘heritage assets’ – sites or structures or buildings deemed to be of archaeological or architectural or historic importance and value. Scheduled Ancient Monuments were established by legislation in the 1880s, and now include a number of Cold War structures. SAMs are generally uninhabited and, indeed, often uninhabitable and often have no current practical use. But they may be, and sometimes are, subterranean. After the widespread destruction of historic buildings in World War II, there was a perceived need to protect what of merit remained standing if not undamaged. The status of Listed Building was introduced as one of the provisions of the Town & Country Planning Act of 1947. This applies to buildings of architectural or historical value, not necessarily habitable.

Particularly interesting lamp posts, for example, may be listed. Entirely subterranean excavated voids cannot be listed, as they are not built structures. But built elements of underground sites, such as masonry tunnel portals, are listable, for example Brunel’s Box Tunnel portals. The Brunels’ Thames Tunnel is listed, so far as your scribe understands it, from end to end, on the grounds that it has a built brick lining.

Listed buildings are described as Grade I, Grade II\* and Grade II, with Grade I seen as of equivalent status to Scheduled Ancient Monuments. Curiously, some structures such as bridges are both Listed and Scheduled. Listed and Scheduled Heritage Assets cannot legally be altered or destroyed without informed consideration. Your scribe was granted Scheduled Ancient Monument Consent, for example, to excavate loose sand and its contents on the floor of the Tunnel Road West sand mine under Reigate Castle. The mine is automatically Scheduled by virtue of lying below the Scheduled Castle. Your scribe also negotiated the recognition of the hearthstone mine shaft at Brockham Limeworks



*An HST enters Box Tunnel in 1988. Photo Paul Haywood* near Boxhill in Surrey within the Scheduled Ancient Monument when the kilns were at his suggestion upgraded from Listed to Scheduled status. Other nationally recognised Heritage Assets include historic gardens, historic battlefields and important shipwreck sites.

SOURCE: FLATMAN, Joe, 2017, 70 years of listed buildings: protecting the past and present. *Current Archaeology* 28(8)(332), 44–51 with additional information from PWS.

### New lease of life for Margate Caves

Thanet District Council has granted the Margate Caves Community Education Trust a long lease, enabling the attraction to reopen following its £1m grant from the Heritage Lottery Fund earlier this year. Thanet is the UK’s fastest growing tourism destination, with a nineteen percent growth in its visitor economy. The council’s Destination Management Plan supports projects that improve the tourism economy and encourage investment.



*Mining engineer Graham Daws (right) and colleague during their recent inspection. Photo Thanet Gazette*

The granting of the lease by the council allows the Trust to access this grant as well as the £420,000 Big Lottery Fund grant it successfully secured last year, thus securing its future. Cllr Hunter Stummer Schmetzing, Cabinet Member for Regeneration and Enterprise Services at Thanet District Council said: Thanet District Council granted permission for the ambitious mixed-use scheme, which includes access to the restored caves, community





facilities, a visitor centre and a landmark building to sit over the caves themselves, back in 2015. Designed by award-winning Tunbridge Wells-based architects Kaner Olette, the building is expected to open in 2019.

SOURCE: Thanet District Council press release, September 2017.

## NEWS – HEALTH & SAFETY

### Fifty people involved in Cornish mine rescue

Rescuers took three hours to reach the man who had fallen into a disused mineshaft at Port Nanven on the coastal path near St Just in Cornwall on 24 September. Devon and Cornwall police had requested the coastguard's assistance at about 1.15pm after receiving a 999 call from a member of the public who said a person had fallen and was injured.

The area where he fell is known for its mining history. The National Trust website says the St Just coastal path walk is located within a world heritage mining site. Describing the walk, it said one mineshaft is located down a hillside and is marked by a signpost that reads "mine shaft, danger of death".



A paramedic and a firefighter were lowered fifty feet on ropes to the injured man who was stuck on a precarious ledge in the shaft. About fifty rescuers, which included a search and rescue helicopter, two coastguard rescue teams, fire crews, ambulance and police, took six hours to bring the man to safety through a narrow constriction in the mine. It is believed Andrew Williams from Wales fell after going to explore the mine and stepping on a wooden cover which gave way. The 51-year-old walker was airlifted to hospital; he was suspected to have sustained a hip injury in the fall and was also believed to be suffering from hypothermia.

SOURCE: *The Guardian*, 24 September 2017.

## NEWS – MILITARY AND DEFENCE

### WWII German PoW escape tunnel found at Bridgend

There were an estimated 69 mass escapes of prisoners of war during WWII. In seven of these it was by German prisoners escaping. Now new scientific investigation has revealed a hidden tunnel that allowed 83 German prisoners to escape from Camp 198 in Bridgend, South Wales, in March 1945.

Camp 198 had been established in 1944 at Island Farm, Bridgend to house 1,600 German officers. Camp security measures were generally poor. Perhaps overwhelmed by the huge influx of enemy personnel, protocols for anti-escape measures took some time to develop. The lack of sentry towers and perimeter lighting on the fences meant that escape attempts were extremely likely. Tunnels had already proven to be the most common means of escape wherever ground conditions permitted.

The clay soils at Bridgend made it harder to dig tunnels than in the sandy soils underlying the Stalag Luft III camp, for example. However the Bridgend tunnels did not need as much shoring support to keep the tunnel intact; a bit of wood salvaged from huts did the trick.

We know the prisoners actually once started a tunnel that was discovered by the guards, perhaps breeding complacency among them. Whatever the case, it did not deter the would-be escapers, and it was a second tunnel, started in Hut 9, that finally allowed them to escape.

Left derelict when it closed in 1948, Camp 198 was mostly demolished in the 1990s. However, Hut 9 was preserved by the local authorities, and remains in remarkable condition providing much evidence of the daily lives of the officer occupants. Hand-drawn graffiti still adorns the prison walls. Much of it is poetry, referring to the "heimat" – home – or to loved ones. One of the graffitied walls in Hut 9 was false, constructed to hide the soil that was placed behind it and never discovered. But what of the tunnel itself? Geophysical investigations outside Hut 9 successfully detected the tunnel's position. The team used ground-based surface scanning to create a surface model of the site. This helped identify variations in the surface, such as depressions which could indicate a collapsed tunnel. They then used ground penetrating radar surveys, which uses radar pulses to image the subsurface, to find the specific tunnel location.



*The tunnel was photographed using a remotely controlled camera*

While the escape tunnel at Stalag Luft III was dug some ten metres below ground – requiring prodigious archaeological effort to reach it – at Bridgend, the tunnel was at a relatively shallow level of 1.50 metres below ground level. Careful excavations by hand eventually

reached the tunnel, which was found to still be remarkably intact. Sawn-off wooden bed legs and materials from the prisoners' huts, used to support the tunnel walls and roof, were still present, just as they had been left in 1945.

Following the German escape, the local police, home guard, army and air force were all mobilised. While one group of prisoners stole a car and got as far as Birmingham, none managed to successfully make their way back to Germany.

SOURCE: Smithsonian.com, 11 August 2017.

### Sweden only has shelter space for seven million people; plans to build more shelters

Sweden's nuclear shelters are insufficient to protect the population from a potential attack, according to a new report from Sweden's Civil Contingencies Agency (MSB). The country currently has 65,000 shelters with space for seven million people in the event of an attack. But it has been fifteen years since new shelters were last built, and the population reached the ten-million mark earlier this year, so the country needs to bolster its protection, according to the agency tasked with ensuring Sweden is prepared for a potential attack.

The report, which was put together at the request of the government, recommends that more bunkers with space to shelter a further 50,000 people should be built over a ten-year period starting in 2019. The project is expected to cost two billion kronor, according to the MSB.

The areas set to be prioritized are Stockholm, Norrbotten county in the far north, the island of Gotland, and the Öresund Region encompassing Malmö. As well as building new shelters, existing ones are in need of refurbishment, at an estimated cost of one billion kronor. This will include improving ventilation and updating respiratory equipment available to the population, for example.



*This sign on a building indicates it has a shelter*

Sweden's shelters are housed in residential buildings, office blocks, and some more unusual locations. They are designed to protect residents from "all weapons that could be used", according to the MSB, including shock waves and shrapnel as vapour deposition, biological weapons, fire, and ionizing radiation.

During peacetime they can be used for other purposes, such as garages for example, but in Sweden's larger cities you're never too far from one of these safe havens. Conspicuous signs on residential buildings indicate the location of a shelter.

SOURCE: *The Local*, 30 September 2017.

### North Korean tunnels are now a popular tourist attraction

During the 1970s, North Korean defectors told officials in the South that President Kim Il-sung had ordered army units to subvert the Demilitarized Zone between north and south Korea by digging tunnels underneath it to prepare for an invasion. Three tunnels were found soon after.

The first tunnel was discovered in 1974 by a South Korean army patrol, which saw steam rising from the ground and heard suspicious noises. A second tunnel was discovered in 1975. South Korean officials estimated that the second tunnel, which extended nearly a half-mile into their territory, could have accommodated up to 30,000 troops an hour.

In 1978, a significantly larger tunnel was discovered south of Panmunjom, the so-called truce village, another popular tourist spot where military personnel on the two sides of the Demilitarized Zone come face to face. A fourth tunnel was discovered in 1990, and while none have been found since, some speculate that dozens have yet to be spotted.



*A South Korean soldier guarding one of the tunnels*

South Korea says the so-called four 'Tunnels of Aggression' were built to move thousands of North Korean troops quickly and covertly underneath the Demilitarized Zone and onto South Korean soil for an invasion, an accusation Pyongyang has long denied.

In the decades since their discovery, some of the tunnels have found new life as a tourist destinations. Thousands of Koreans and foreign visitors explore these odd relics of a frozen conflict, one that is now stressed by renewed tensions.

Tourists in the South are able to visit three of the tunnels through guided tours. For the equivalent of \$10, according to South Korea's official tourism site, visitors can explore the most popular of the passageways, the 'Third Tunnel



of Aggression,' located at Dorasan Observatory in South Korea's northwest. This tunnel was deemed to be "the most threatening as an invasion tool" by the tourism office because of its proximity to Seoul, just 32 miles away.

The tunnel is 240 feet below the surface. Tourists enter through a gift shop before beginning a steep descent. They wear helmets to protect themselves from the low ceilings. While tourists can see the North Korean handiwork, what they cannot do is cross the border, as the passage to the North is now blocked by concrete slabs.

SOURCE: *New York Times*, 4 November 2017.

### More than just a basic air-raid shelter at Berwick-upon-Tweed, Northumberland

Archaeologist Lindsay Allason-Jones, an archaeologist specialising in Roman material culture, found herself in possession of what at first appeared to be a Second World War Anderson air-raid shelter when she bought a Victorian villa in Berwick-upon-Tweed. Archaeologists from the University of Newcastle-upon-Tyne were called in to investigate. The cited authors are specialists in industrial and conflict archaeology.

The structure in the back garden, however, was clearly not a standard issue Anderson, of which over three million were erected during the war. It was indeed found to be lined with corrugated iron sheets, but was longer and narrower than the standard shelter. Nor had it been constructed in a pit dug in the garden, but tunnelled into rising ground overlooking the Royal Border Bridge over the Tweed.

Where standard Andersons were generally earthed over with fifteen inches of soil, this shelter had an eleven-inch concrete shell. The internal corrugated-iron walls rested on low brick walls, giving more headroom than a standard shelter. There was also a concrete floor, and a concrete back wall through which an iron pipe was seen to contain the remains of an electric cable connected to Bakelite light and power sockets in the shelter.



Examination of the house interior revealed no evidence that that had been the origin of the electricity supply, but parts of what may have been the base of a radio mast found nearby suggested the function of the structure was as a part of a wartime wireless intercept network.

A stencilled metal sheet uncovered at the entrance was found to read WILMOT'S FORTRESS AIR RAID SHELTER. Wilmot, it seems, was not a wartime owner of the house with a DIY shelter, but perhaps the proprietor of S.M. Wilmot & Co Ltd of Bristol, manufacturers of prefabricated sheet metal structures for the agricultural market in the 1930s. That company's products included 'Wilmot's Palace Hen House'!

Interpretation of all available evidence suggested that this was not a standard and very basic domestic shelter. The Royal Border Bridge, overlooked by the site, carries the strategically important main rail line from London to Edinburgh, and the town did indeed suffer air raids. The shelter appears to have been an element in a wartime communications network, perhaps the Secret Intelligence Service's Radio Security Section, it is suggested.

SOURCE: BOWMAN, John, Andrew MARRIOTT, and Tom WHITFIELD, 2017, Listening to the past: decoding the secrets of a Berwick-upon-Tweed air-raid shelter. *Current Archaeology* 28(8)(332), 52–55.

### RAF Saxa Vord reopens

Saxa Vord on the island of Unst in the Shetlands used to house a radar station capable of scanning Atlantic waters from Iceland to Norway, but the Ministry of Defence shut it down in March 2006 as Russian relations eased. The MoD announced in September that the site will reopen in October with a new radar system and a team of about thirty specialists soon set to arrive on the UK's most northerly island.

The remote island, where the nearest station is in Norway, featured on a secret list of UK Soviet targets during the Cold War period. The island has marketed Saxa Vord as a tourist resort since the closure of the radar station, which saw the island's population halve to just six hundred.



*HF200 radar beneath the radome and covered walkway to the R10 operations block on the hillside below*

At one time there were 250 RAF personnel here, many with their families. There was a power station, a fully manned fire station and a medical centre with a dentist. Local politicians have hailed the reopening as 'excellent news'.

SOURCE: *MailOnline*, 17 September 2017.

## Underground missile launch site in Wyoming to open to the public in 2018

Cheyenne, a new state park at a former launch command site for one of the world's most powerful nuclear missiles, remains on track to open in Wyoming next year, though state officials said in early November they are still figuring out how to pay for staffing and maintenance.

The U.S. Air Force has been renovating the Quebec-1 site; the last of its kind since the deactivation of the Peacekeeper missile in 2005. A defence spending bill making its way through Congress could transfer the site to Wyoming in early 2018.



*A tunnel allows access to an underground bunker housing the launch control centre*

Starting in the mid-1980s, F.E. Warren Air Force Base in Cheyenne oversaw 50 Peacekeeper missiles, each of which carried as many as 10 nuclear warheads. At the Quebec-1 site about 25 miles north of Cheyenne, a building resembling an ordinary ranch house provides access to an elevator leading to a missile alert facility. Behind an 8-ton blast door 70 feet underground, pairs of airmen called missileers worked 24-hour shifts, ready to launch Peacekeeper missiles from silos in the ground miles away. Tourists will be able to go underground to the steel-reinforced concrete capsule. The site could draw 50,000 to 60,000 visitors a year, requiring one full-time employee and two seasonal workers besides volunteers.

SOURCE: *Casper Star Tribune* 7 November 2017.

## The Irish government had their version of Burlington

In the 1960s, the Irish government was so concerned about a nuclear attack that it urged householders to stock up on groceries for 14 days – just in case it happened. *Bás Beatha* (Survival in a Nuclear War – Advice on Protection in the Home and on the Farm), a guide to surviving a nuclear war, was distributed to every home, telling the public what to do when Doomsday came and the country was hit by a nuclear blast. And the government itself, including the Taoiseach, was all set to find refuge in their own special VIP bunker at Custume Barracks in Athlone.

At the height of the Cold War, in the years after the Cuban Missile Crisis, the government ordered the construction of the nuclear bunker in Athlone. For decades, there was a plan that the midlands town by the banks of the

Shannon would become the effective capital of Ireland in a nuclear-war scenario.

Athlone was picked because it was right in the centre of Ireland, and it had good radio communications. In the event of a threatened nuclear strike, the Taoiseach, his ministers and top civil servants were to decamp to Athlone, and live underground until the radioactive dust had settled.



*The Athlone control room*

Hordes of volunteer telephonists were supposed to be in the bunker monitoring how the rest of the population above ground were doing. Readings were to be taken by wardens across the country, and then phoned into Athlone. The bunker also housed a conference room with maps and a broadcast studio where RTÉ would issue bulletins. From here, the Taoiseach would give an address on the state of the nation. According to some accounts, the bunker even had a special closed telephone line to 10 Downing Street in London.

The Athlone bunker was designed so that even if the building above it collapsed, its reinforced concrete ceiling could withstand the force. A government memo from the 1960s outlined survival plans for a nuclear war. It was envisaged that ministers, civil servants and military advisers would have cooking facilities sufficient for a period of up to 30 days. It was believed that the shelter was to accommodate up to 100 people.

Although the Athlone bunker was to be the nerve centre and home for political VIPs amid the radioactive fall-out, it is not clear how the cabinet was supposed to get there. There were several dress rehearsals for the nuclear emergency in the 1980s, including Network 84 in 1984, when the country's public-warning system was tested out at the bunker. Charts were plotted for fall-out plumes being carried westward over Ireland after simulated nuclear strikes in Britain. According to one press report, the atmosphere in the bunker for the night-time dress rehearsal was cheerful, but it was also a little unreal.

SOURCE: *Irish News*, 5 November 2017.

## A Dutch village air-raid shelter near Gulpen, Netherlands

Most of the Netherlands, being low-lying with a shallow depth water table, was far from ideal for



making subterranean air-raid shelters during World War II. Basements, if dry, might have been reinforced, or concrete surface shelters built.

In the hilly south of the country however, in Zuid Limburg province, many of the chalk hills were already extensively quarried by tunnelling for building-stone. Very extensive ancient quarry tunnel systems near both Maastricht and Valkenburg provided shelter spaces for thousands of civilians. These are spacious and dry tunnel complexes with very high ceilings, excavated in the Maastrichtian Limestone, a somewhat gritty yellow variety of chalk. Subterranea Britannica members who were at the Maastricht Study Weekend will recall visiting several of these in both the Netherlands and, just a mile or two away, also in Belgium.

Some way to the east of Maastricht the hills are of a different kind of chalk, the white flinty Gulpen Chalk, not suitable for use as a building-stone. The villages of and near Gulpen and Wilre, therefore, had no ready-made tunnels in which to shelter during air raids. Some details of a small rock-cut tunnelled shelter supplied by Joep Orbons are of interest.



*Entrance to the shelter. Photo Joep Orbons*

The main shelter is a straight unlined rock-cut tunnel running north-south, perhaps twenty or thirty metres long and seemingly wide enough for narrow wooden benches each side (remains of which are still on the floor), but probably not wide enough for bunks. This was, therefore, likely to be a place of refuge to which people could go on hearing an air-raid siren warning, rather than a secure place in which to sleep overnight.

Two short entrance tunnels to the west, both of which are now backfilled, have shallow alcoves each side, perhaps to accommodate buckets behind modesty curtains as makeshift lavatories. There are no signs of a water supply or drainage. From the south end of the main shelter there is a much narrower but walking-height unlined emergency escape tunnel through crumbly chalk continuing on the same alignment, leading to an exit closer to habitations than the main entrances.

This exit is offset from the rest of the tunnel by right-angle turns to the east and then south again. The few metres of

this east-west part of the tunnel have been driven between two parallel joints in the rock, with the consequence that two or three very large lumps of chalk have fallen from the ceiling, rendering access now slightly awkward. This dog-leg was presumably made deliberately as a protection against bomb blast directly affecting the interior.

Some iron nails hammered into the side walls of the shelter tunnels at ceiling height suggest there may have been electric wiring and lighting, although no other electrical fittings or external mains supply appear to have been noted. No soot marks are reported, such as might have been left by candles. The exit is provided with a locked steel gate, and is now the site of a small shrine dedicated to Mary.

A curious feature is that the route to the main entrances from the nearest houses is a steep uphill path which passes the emergency exit before they are reached. A lower-level tunnel with entrances closer to the houses would have been much easier for the elderly and children to reach quickly. It appears that no documentation relating to the formation or use of this shelter has been located, although others of similar form are known in the district.

SOURCE: Information from Joep Orbons with additional comment by Paul Sowan.

### **ROC Yeovil headquarters finally sold after 16 years**

The Asare-Joy family decided the time was right to leave Sidcup, Kent, and pack up the whole family and move to Somerset for a complete change of lifestyle. But despite being on the lookout for another family home, dad Richard came across what he thought was the perfect property for sale online – a five-bedroom timber-clad eco-house in Yeovil which had been converted from a Cold War bunker.

Previously, the site housed the 9 Group Royal Observer Corps headquarters. Built in 1963, the ROC headquarters at Southwoods was one of eleven similar semi-sunken concrete bunkers known colloquially as Aztec Temples where volunteers had spent 30 years planning for the eventuality of nuclear annihilation.



After stand-down in 1991 the bunker was retained by the Home Office, acting as a nodal point for the emergency communications network which was established there in July 1993 under the guise of G-CAT Computer Centre.



This included the installation of a new SX2000 ECN unit, two computer terminals and a second standby generator. Sometime in the mid-1990s the site was offered for sale but the council refused planning permission for four houses on the plot. The sale was abandoned and the centre remained in use until the spring of 2001 with an upgrade to the ECN equipment in 1999.

Since closure in 2001 the bunker has passed through the hands of a number of different property developers and it was eventually converted into a private dwelling with 8,000 square feet of living space over four floors including five bedrooms, three reception rooms and a large gym. The Asare-Joy family snapped it up this year for just under £700,000 and the family have now moved into the converted bunker. The bunker still retains its old generators and other equipment.

SOURCE: *Daily Mirror*, 3 November 2017 and Sub Brit website.

### Increased demand for domestic nuclear shelters, USA

Sales of ‘personal bomb shelters’ offering protection from radioactive fallout from thermonuclear weapons are reportedly ‘booming’ as a result of heightened nuclear tension following bomb and rocket tests and accompanying American and North Korean rhetoric.

Atlas Survival Shelters, a Californian company, is reported to have sold thirty such shelters ‘in just three days last week’, compared with ten sold in 2011. The shelters cost up to \$100,000 each (£78,000). They contain generators and bunk beds.

SOURCE: ACKERMAN, Naomi, and Kate PROCTOR, 2017, Sales of personal nuclear bunkers boom as China seeks to calm Korea tensions. *The Evening Standard*, 16 August 2017, page 18.

### Two-level Cold War bunker in Inverness is on the market

The former two-level Highland Emergency Centre at Raigmore, Inverness, has been put up for sale by the Highland Council.

The bunker was built as part of the RAF 13 Group Sector Operation Centre during WWII. The SOC consisted of three separate bunkers, an ops room, a filter room and a communications centre. The ROC used the ops room and that has now been demolished as has the communications centre. In 1988 the filter room was acquired by the Highland Council and with a 90 percent Government grant it was converted into their emergency centre, also incorporating the Inverness Borough Emergency Centre. The filter room has had a five million pound refit which includes a massive water tank in the basement and a new ventilation system and blast doors. Externally the grass-mounded bunker is little altered although the main access has been rebuilt for use as the council’s Emergency Planning Centre.

The bunker was kept in a state of readiness and was regularly used for training exercises. When fully manned



*Inverness Control Room. Photo Nick Catford*

there would have been a staff of approximately thirty, a small number for such a large bunker. The bunker was called into action on numerous occasions to coordinate responses to major national emergencies. They included the 2001 foot and mouth outbreak, the Summer Isles grounding of the *Jambo* freighter in 2003, and a response to major floods that affected Dingwall and other parts of the Highlands in 2005 and 2006.

The police have used the facility in recent times for armed training exercises. Highland Council are handling the sale. Offers are invited.

SOURCE: *Inverness Courier*, 23 October 2017 and Sub Brit website.

## NEWS – MINES AND MINING

### Box quarries sealed after two rescues in three days

In July firefighters and cave rescuers have had to attend Box underground quarries near Corsham, Wiltshire, twice in three days to assist parties in trouble underground. On 2 July 2017, Corsham Fire and Rescue assisted a group of three who had entered the quarries via Back Door entrance and made their way to Jack’s Working entrance where a recently installed grille blocked their exit. They were able to use their mobile phones to call for help and a small team from Mendip Cave Rescue led them out through a nearby entrance.



*Lady Hamilton’s Hole II. Photo Mark Jenkinson*

Three days later, in an almost identical incident, a party of seven youths from Bristol entered Box Quarry via the Back Door entrance at about 11pm on 4 July 2017. They made their way to Jack's Working entrance but found this had been grilled in the couple of weeks since their last visit there. They were unwilling to return to the Back Door to exit as the torches on their mobile phones were running low on battery.

Following these two rescues, quarry owners Hanson UK have now grilled Lady Hamilton's Hole II entrance and the existing bat grille at Backdoor which was left open has now been welded. All access to Box quarries is no longer possible.

There used to be 10 entrances to the Box mines, and originally they were probably all separate quarries which eventually joined underground. These entrances were known as Eastgate, Westgate, Northgate, Bridgegate, Lady Hamilton's Hole I, Lady Hamilton's Hole II, Hazelbury, Clift, Backdoor and Jack's Workings. All these entrances were adits, which means that they open in to the side of the hill or a cliff face. In recent times Lady Hamilton's Hole II, Jacks and Backdoor have been open while Clift has a welded door that has been used for rescues.

SOURCE: *Darkness Below* 17 July 2017.

#### Historical accounts of the coalfield in South Wales

Two splendidly illustrated accounts of aspects of the history of the South Wales coalfield have been published in a recent issue of the magazine *Archive*, a periodical devoted to industrial and transport history, and noted for its high quality reproductions of historic photographs and, usually, relevant extracts from older editions of the Ordnance Survey large scale plans at, usually, 25 inches to the mile.

SOURCE: DAVIES, Brian, 2017, The Hetty winding engine and the development of steam winding engines in the South Wales coalfield. *Archive* 95, 2–37.

JACKSON, Pam, 2017, Horse haulage in the South Wales coalfield. The final decade. Part 4. *Archive* 95, 38–47.

#### Exploration of sixteenth-century copper mine at Bridge of Allan, Scotland

Exploration of a small copper mine at Bridge of Allan has been reported. The report includes a plan, section, and two underground photographs. The section shows four shafts, four levels, and three stopes (steeply inclined mineral veins from which ore has been mined).

SOURCE: STANFORD, Mark, 2017, Airthrey 16<sup>th</sup> century copper mine, Bridge of Allan. *Bull. Grampian Speleological Group*, 5<sup>th</sup> Series, 2(3), 11–14 and 21.

#### Metalliferous mining heritage in the Isle of Man

The Laxey and Lonan Heritage Trust, formed in 1987, has celebrated its thirtieth anniversary this year. The discovery of lead, zinc and silver ores on the Isle of Man in the mid-nineteenth century transformed Laxey from a quiet fishing village to a mining district with huge piles of stone waste, mine shafts, and winding-houses powered by water-wheels.

The iconic Laxey wheel with a diameter of 72 feet 6 inches was built in 1854 and named *Lady Isabella*. Its function was to pump water out of the mines. It is now a major tourist attraction, the largest working water-wheel in the world, run by Manx Heritage. The Trust, in collaboration with the Laxey Mines Research Group, has restored *Lady Isabella*'s sister wheel, the Snaefell Wheel now known as *Lady Evelyn*, built in 1865.



*Lady Evelyn Wheel. Photo John Zebadee*

This 50-foot wheel was built at the Hawarden ironworks in Flintshire, North Wales, but was relocated in 1908 to a china-clay pit in Cornwall, and then in 1976 to the Llanwernog silver mine in Ceredigion in Wales. It has now returned to the Isle of Man, and has been back in working order since 2006. Visitors today reach the two wheels by riding the Great Laxey Mine Railway, restored with replica steam locomotives by the Trust.

SOURCE: LAXEY AND LONAN HERITAGE TRUST, 2017, The Laxey and Lonan Heritage Trust. *Current Archaeology* 28(8)(332), page 66 [Isle of Man: established in 1987]. <http://laxeyminralrailway.im/laxey-lonan-heritage-trust>

#### Mine engine house now converted to residential use, Cornwall

A former Cornish engine house has been converted into a five-floor holiday home at an undisclosed location, although as the owners propose to make it available to others to rent when not themselves resident, enquiries to [uniquehomestays.com](http://uniquehomestays.com) may reveal details.

All sorts of buildings, including redundant churches and railway stations, and even gasholders, have been converted into homes, thus preserving their external appearance if not their internal arrangements. Presumably there is a mine shaft somewhere under this property, not to mention a high radon count! Several internal and external photographs of the building as restored are in the source cited.

SOURCE: STALLWOOD, Oliver, 2017, Turning an engine house into a home. *Metro*, 11 October 2016, 6–7.

## NEWS – MISCELLANEOUS

### **Congratulations to the Gloucester Speleological Society 1956–2016**

The Gloucester Speleological Society was formed in 1956 by the amalgamation of two small groups of teenage caving enthusiasts with a shared interest in, predominantly, ironstone mines in the Forest of Dean and underground building-stone quarries in the Cotswolds, as well as in natural caves.

The Society has flourished and celebrated its sixtieth anniversary in 2016 with an (above-ground) dinner and by issuing a 74-page A4 booklet in which the Society's origins and first 50 years are outlined, and development in the last ten years addressed in more detail. This supplements a similar publication issued in 2006 which documented the first half-century.

The booklet was compiled / edited by Jon Maisey (Chairman) who will be remembered by those of our members who attended the Sub Brit Study Weekend he led for us based at Cirencester in 2015. The profusely illustrated anniversary booklet contains details of the Society's activities underground especially in Gloucestershire but also elsewhere in the UK and abroad. Despite its name, GSS is very much more than a caving club. Much of its work has been in man-made subterranean sites just such as form our own core interests, including culverted rivers and streams, the Redcliffe 'caves' at Bristol, the Sapperton canal tunnel, and especially importantly underground stone quarries such as at Westington, Westwood and Windrush. The opening up of the Windrush quarries and their exploration is, as the Study Weekend attendees will recall, especially impressive.

The Gloucester society members are not armchair enthusiasts, and not 'butterfly' collectors of as many one-off visits to sites as they can make. These are practical hands-on people actively engaged in exploration, digging, recording and conservation. They also have a record of playing a leading part in bat conservation and the regional cave rescue organisation. Hats off to a dynamic group!

SOURCE: GLOUCESTER SPELEOLOGICAL SOCIETY, 2017, *60 years underground with the GSS 1956–2016* [Edited by Jon Maisey]. Gloucester Speleological Society: 74pp.

### **'Underground city' to become Chicago's next attraction, USA**

Not many people know about the Pedway, a network of tunnels connecting shops and businesses beneath downtown Chicago, but it could become the city's oddest tourist destination.

In some ways it's just like any other Chicago neighbourhood. There are three Starbucks, a gym, a department store and a friendly dive bar. But no one lives here. There's no natural daylight. And many Chicagoans have never heard of it.

The Pedway is a network of tunnels running beneath forty blocks of the Loop, Chicago's central business district. Built piecemeal since 1951, it provides a weatherproof route for pedestrians to walk between buildings, though relatively few use it. Many stores, hotels and bars connected by the network have entrances at street level and underground, while a few cafes serve only the Pedway. The layout is more maze than grid. Each building linked to the underground network is responsible for its section of the Pedway, so no one is in charge. Few attempts have been made to promote its use – until now.



*One of the Pedway's many long, empty corridors, This pedway heads west from the Jackson Blvd. Red Line and heads to the Kluczynski Federal Building and Dirksen Federal Building. Photo Cragin Spring*

A local not-for-profit organisation, the Environmental Law & Policy Center, has raised \$125,000 to spruce up the tunnels and turn them into a tourist attraction. In July, the centre announced plans to promote the Pedway "both as a destination and as a desirable way to move around downtown". Its vision includes an underground library, art galleries and a farmers' market. A glass cube in Millennium Park would provide public access – an attractive alternative to the stairwells and escalators within buildings connected to the tunnels that are currently the only way in.

SOURCE: *The Guardian*, 9 September 2017.

### **British Geological Survey Archive now available online**

Full understanding of any subterranean site cannot be achieved without due consideration of the rock and subsoil into which it was excavated. Geology as a recognised science had early beginnings in Great Britain, the world's premier geological society (the Geological Society of London) having been founded in 1805, and at least one of the oldest national geological survey institutions having been established as the Geological Survey of Great Britain in 1835. Both bodies have published vast quantities of researches concerning the rocks of the British Isles continuously since their foundation, and continue to do so.

The Geological Survey of Great Britain (GSGB) was renamed the Institute of Geological Sciences (IGS) in





1965, and renamed again as the British Geological Survey (BGS) in 1984. Virtually all of the Survey's printed publications from 1835 to date are now available free to view online. They are delivered as colour image files for online viewing, and are best consulted on a desktop PC, laptop or tablet PC. The BGS publications viewer can be consulted and searched at

[www.bgs.ac.uk/opengeoscience/publications.html](http://www.bgs.ac.uk/opengeoscience/publications.html), along with portals to view BGS printed maps online as well as a range of more recent electronic publications.

SOURCE: BRITISH GEOLOGICAL SURVEY, 2017, BGS Archive of its printed publications. *History of Geology Group Newsletter* 60 (June 2017), 25–26.

### **Thieves break into wine cellar through Paris catacombs**

Thieves have stolen 300 bottles of fine wines worth £230,500 from a cellar in central Paris after breaking into the trove of vintages from the catacombs, the maze of mainly off-limits tunnels under the French capital.

The apparently well-informed thieves broke first into the catacombs from one of many secret or sealed entrances around Paris before drilling a hole through the cellar wall of the property near the Luxembourg gardens which houses the French Senate.

“After stealing the grands crus, they quietly vanished back underground”, said police, adding, “One can assume that they had made reconnaissance missions and that the criminals didn't drill through this wall by chance.” The owners have only recently discovered the theft but it could have taken place any time between late July and late August this year.

The cellar was under a block of flats in rue d'Assas, which runs right next to the Luxembourg gardens. Two other cellars were also broken into but nothing was stolen from them.

SOURCE: *Daily Telegraph*, 30 August 2017.

### **Anglo-French undersea power cable underground on Alderney, Channel Islands**

The Development Manager of FAB Project, a proposed subsea and underground electricity interconnector cable linking France to England via Alderney, has responded to claims that construction would desecrate war graves on the island.

Longis Common was the burial place for victims, including slave labour, of the Nazi WWII occupation of Alderney. Chris Jenner points out that the victims were exhumed more than fifty years ago and reburied in France. Various other underground utilities have subsequently been routed across the Common.

All appropriate authorities have been consulted, including the States of Alderney (owners of the Common), and the Committee for the Preservation of Jewish Cemeteries in Europe. The purpose of the cable is to increase energy security, paralleling for example the four closely spaced power cables across the Straights of Dover, two of

which were accidentally put out of action recently (see *Subterranea* 45, page 18).

SOURCE: JENNER, Chris, 2017, Alderney image not a true picture. *The Sunday Times*, 24 September 2017, page 22.

### **Recollections of Harry Pearman, Hon. Member of Subterranea Britannica**

One of the most important sources of information, usually with plans, relating to underground sites of all kinds in southeastern England is the series of *Records* volumes published by the Chelsea Spelaeological Society and its predecessor the London Spelaeological Group from 1956 onwards. A great many of these volumes are the work of Harry Pearman, who was made an Honorary Member of Sub Brit in recognition of this work. Other authors or co-authors have included Brian Hillman and Rod LeGear. The London Spelaeological Group was established in 1938. In 1959 the LSG was amalgamated with the CSS which had itself been formed in 1956 with Harry as a founder member. The CSS originated as the 1st Chelsea Rover Scouts. Both groups were essentially caving clubs whose members explored natural caves in the Mendips and South Wales, but the southeast having few natural caves received much attention from them, with the LSG publishing two volumes of its *Records* in 1956 and 1958. After the amalgamation of the LSG and CSS in 1959 the latter body has continued the *Records* series from number III (*Secret tunnels in Surrey*) onwards, issued from 1963. Almost all the volumes are devoted to underground places in the Home Counties, and contain early accounts of, for example, building-stone mines in Surrey, chalk mines in several counties, and numerous miscellaneous and mysterious tunnels and crypts and so forth, many accounts containing first-hand observations made by members.

Many others, including former SB chairman and secretary Paul Sowen, have also contributed information from field observations or from archival and published sources. CSS has also published a *Newsletter* continuously from 1956, which also contains Home Counties material. Paul Sowen, as Archivist and Librarian of the Croydon Natural History and Scientific Society, has the care of complete and continuing sets of the *Newsletters* and *Records*.

The cited source is an article by Harry concerning his recollection of an early caving trip in Ogof Agen Allwedd, an extensive natural cave complex in south Wales, during which CSS members were almost trapped underground by floodwater following heavy rainfall.

SOURCE: PEARMAN, Harry, 2017, Choked. *Newsl. Chelsea Spelaeological Society* 59 (7/8/9), 54–57 with additional historical details from PWS.

### **Joep Orbons MA**

Congratulations to Sub Brit member Joep Orbons on being awarded an MA degree by the University of Amsterdam for his work on underground archaeology



in Mergelland – an informal term for the area of the Maastrichtian Limestone outcrop in the southern Netherlands and adjoining parts of Belgium noted for numerous and extensive underground building stones and important prehistoric flint mines. The details of his thesis are:

ORBONS, P.J., 2017, *An archaeology of the darkness: man-made underground structures in the Mergelland region as a source of archaeological studies*. University of Amsterdam: MA Thesis, June 2017: 115pp. [The text is in English]

### Death of Deryck Laming

The death has been announced of geologist Deryck James Colson Laming [1931–2017], an active member of Subterranea Britannica in the 1980s who will be remembered mostly by members for his assistance with a study weekend based in Exeter, with visits to micaceous haematite mines, the underground Beer chalk quarries and, of course, the ancient Exeter water supply tunnels. Deryck contributed articles and reports published in the Subterranea Britannica *Bulletin* on the reopening of the Beer quarry ‘caves’ as a visitor attraction and the new tunnel dug into the limestone mine at Dudley (*Bulletin* 19, 1984) and on our Study Weekend at Ironbridge (*Bulletin* 22, 1985).

### Prehistory of the Tyburn, now part of the sewers system, London

One of the ‘lost rivers of London’, most of which have been culverted and/or incorporated in nineteenth-century sewers, has been the subject of historical and archaeological research for some years.



*An antiques shop claims that part of the river flows through an open conduit in its basement*

It has long been thought that this small tributary of the Thames, rising at Hampstead, flowed past Buckingham Palace where it divided into two streams, one flowing east towards Westminster, the other past Victoria Station towards Vauxhall Bridge. Recent archaeological excavations near Victoria cast some doubt on the latter route.

SOURCE: YENDELL, Virgil, and Robert SCAIFE, 2017, Invisible people next to a river that does not exist:

geoarchaeology and the Tyburn River north of Victoria Station. *London Archaeologist* 15 (2), 31–36.

### Provision for winter accommodation for bees underground, Greenwich, London

Bees don't like English winters. Skeps (old-fashioned straw beehives) with their bees inside were kept in specially-made storage niches in cellar walls, especially in southeast England.

Some well-preserved examples have been revealed in what remain of the vaulted cellars of the former Tudor palace underneath the Old Royal Naval College at Greenwich. Provision is being made for public access.

SOURCE: MOORE, Peter, 2017, Tudor bee boles at the Palace of Placentia. *London Archaeologist* 15 (2), 41–42.

## NEWS – PUBLICATIONS

### Quarrying in Yorkshire

DETAILS: JOHNSON, David, 2016, *Quarrying in the Yorkshire Pennines: an illustrated history*. Stroud: Amberley Publishing: 96pp [ISBN 9781-4456-5367-9]

David Johnson's established reputation as a reliable historian of the mineral industries is further enhanced by this further and splendidly illustrated volume on the extraction of stone of various kinds for building, millstones and other such shaped pieces. Broken stone won as aggregate, gravel, sand and other such materials in general are not considered, as 'quarry' here is used in its historical rather than modern legal sense. Five chapters are devoted to slate or other fissile rocks, chert, limestone, sandstone, fireclays and ganister.

Additional chapters address quarrying methods, processing and transport. Although the majority of the sites described and illustrated are opencast, several underground workings are also featured, some of them not previously known to your reviewer. There is a very useful list for further reading, and an index of named quarries.

## NEWS – TUNNELS & TUNNELLING

### North Korean tunnel collapse may have killed 200

At least two hundred people have been killed at a nuclear test site in North Korea after a tunnel collapsed, according to an unverified Japanese media report.

The collapse is said to have taken place during the construction of a new underground facility at the Punggye-ri site in northeastern North Korea. The claims, apparently made by an unnamed North Korean 'source', have been denied by the North Korean government.

According to Japan's TV Asahi, up to one hundred people had been trapped in the tunnels and a further collapse happened during attempts to rescue them, raising the death toll to at least two hundred. The incident is believed to have happened on October 10, but another news agency, South Korea's Yonhap, said it was still unclear when the disaster took place.

SOURCE: *Daily Mail*, 1 October 2017.



### Bicentenary of the Tavistock Canal, Devon

The Tavistock Canal, linking the town to the industrial and mining area and port at Morwellham on the river Tamar, opened to traffic on 24 June 1817, having taken fourteen years to construct. The canal is four miles long, of which 2,540 yards is in tunnel under Morwellham Down. The structure incorporated an aqueduct to convey a branch to serve slate quarries at Mill Hill, and a 237-yard incline plane at the port end.



*Southern portal of the tunnel*

The canal promoters had in mind, apart from creating a means of conveying goods to or from the port, the possibility of discovering mineral veins that might be worth mining. The museum at Tavistock is presenting an exhibition to commemorate the canal, and the Trevithick Society plans publication of a definitive account of the archaeology and history of it to be written by Robert Waterhouse. The long-abandoned canal is evidently derelict, and the cited source is silent on the question of access to the tunnel.

SOURCE: THORNE, Graham, 2017, Tavistock Canal bicentenary. *Industrial Archaeology News* 181, page 16.

### New light on the closure of the Post Office Railway (Rail Mail) in 2003, London

Alan Williams' well-informed commentary on Britain's railways published each month on the last page of *Modern Railways* is one of that periodical's most popular features. In the October 2017 issue he remarks on the reopening of a small part (the station and associated tunnels and depot) at Mount Pleasant, now open to visitors to the new Postal Museum.

As a former member of the Post Office Board, he offers some insights into why the Paddington to Whitechapel private railway closed in 2003. It was exclusively used by automated electric trains carrying letters, packets and parcels between London sorting offices. The official reason for closing this entirely underground railway was that the 'operation eventually became uneconomic'.

Privatisation of both the Post Office and the railways, along with declining letter traffic resulting from the popularity of email, had parts to play. The whole purpose of the Post Office Railway was to provide faster transits

by rendering unnecessary a fleet of mail vans on London's congested streets (no less congested now than they were when the line opened in 1927). It is material to add that although the bulk of letters sent by mail has declined, that of packets and parcels has risen dramatically, another result of the internet as items ordered online are delivered by mail.



*Train standing in the eastbound platform at Mount Pleasant in 2003, as few weeks before closure. Photo Nick Catford*

The pre-privatisation plan for the more efficient handling of mail was for the creation of what was to have been the rail-linked seven-platform Princess Royal mail handling centre at Wembley replacing all the central London sorting offices other than Mount Pleasant, linked by mainline mail trains to half a dozen other strategically located centres nationwide. This was, crucially, to be served by an extended Post Office Railway a few miles westwards from Paddington.

A tunnelled extension was one option. A surface lines extension would have required a weatherproof 'surface tunnel' as the electric trains on the POR were designed to spend their entire working lives underground! In fact two dedicated POR platforms were actually built at Princess Royal. But privatisation was going to be complicated enough, without throwing into the mix major works to improve the Post Office and rail infrastructure. So now we have much increased bulky packet and parcel vans still clogging the London streets.

SOURCE: WILLIAMS, Alan, 2017 (Alan Williams' column). *Modern Railways* 74 (829), page 98.

### Biggest bank robbery ever foiled in Brazil

Brazilian police have caught a bank robbing gang who had spent four months digging a tunnel into the main vault of the national bank containing £240million. Police found the 550-yard-long tunnel in southern Sao Paulo, leading from the robbers' lair to a branch of the Bank of Brazil. Had the robbery been successful, it could have been the biggest bank robbery in history.

The tunnel led from a rented house where the gang had been holed up, and straight into the vault. Images show

it propped up with wooden planks and iron bars, with tools left behind and lights to lead the way inside the tunnel. Sao Paulo investigators had spent two months monitoring the group, and it was the completion of the tunnel that sparked the arrests.



The gang's investment was in the range of 4 million real (£958,808). Each of the participants put in 200,000 real (£47,940) and their estimate was to take one billion real (£240million). Sixteen members of the gang have so far been arrested, and Sao Paulo police say all leaders are in custody.

SOURCE: *MailOnline*, 4 October 2017.

#### Disgusting blockage in Whitechapel sewer, London

Investigation of a sewer blockage in east London has revealed the cause to be a huge mass of all the things people flush down their toilets such as tampons, nappies, wet wipes, and the like, all stuck together by waste cooking oil from commercial and domestic premises.

The mass is estimated to weigh as much as 11 double-deck London buses (130 tonnes), blocking about 250 metres of a sewer 0.7 metres wide and 1.2 metres high, posing a risk of raw sewage overflowing into streets and adjoining properties. A team of eight workmen was reported to be working seven days a week to clear the blockage, a task likely to take three weeks. Twenty to thirty tonnes of congealed waste are removed each day, from a very confined and unpleasant space.



Thames Water will of course pass the cost onto their customers, in their water bills. The firm spends about £1m each month clearing blockages of this kind. The Whitechapel 'fatberg' is one of the largest so far reported

in London. Such an iconic and tangible sample of the 'material culture' of 21st-century London as this latest 'fatberg' simply has to be recorded as a reflection of how we live today.

A representative section of the blockage may be acquired by the Museum of London! And no doubt 'fatberg' will be added to the forever expanding word hoard of the Oxford English Dictionary, the updated version of which is now maintained online.

SOURCES: FISHWICK, Samuel, 2017, Grease is the word. *Evening Standard*, 14 September 2017, 32–33; GREENFIELD, Patrick, 2017, London sewer fatberg on its way to museum. *The Guardian*, 14 September 2017, page 19; TAYLOR, Matthew, 2017, Monster 'fatberg' found inside London sewer. *The Guardian*, 13 September 2017, page 5.

#### Mystery surrounds seven-mile tunnel under Coventry

Mystery surrounds the location and purpose of a seven-mile-long tunnel under Coventry city centre.

It follows the discovery of three old photographs showing men at work inside the structure nearly fifty years ago. The pictures are dated 17 March 1970 and show workers hunched inside a tiny tunnel. The captions clearly state that the workers are digging a tunnel under Coventry city centre, but historians and city clerks are at a loss to explain what they tunnel might be used for – and whether or not it's still there.



The work can't have been to culvert the River Sherbourne through the city centre because that happened in the 1960s, and the famous sewer scenes in the *Italian Job* had already been filmed two years earlier. It also appears way too small for either cars or trains.

SOURCE: *Coventry Telegraph*, 4 October 2017.

#### Drive shaft tunnels under Mellor Mill, Marple, Greater Manchester

Mellor cotton spinning mill at Marple, ten miles southeast of Manchester, was when completed in 1792 the largest of its kind in the world. The building, destroyed by fire in 1892, was 200 feet long and of six storeys.

The power source was at first a 22 ft diameter water-wheel with a width of 15 feet, turned by the River Goyt. Second and third wheels were added in 1797 and 1815.



Tunnels were provided under the river and under the adjoining road to accommodate the tailrace and drive shafts into the mill.

Members of the Newcomen Society visited the site in April 2017 to see current archaeological work on what remains of the mill, including an 1815 tunnel for an extraordinarily long (700 feet) drive shaft. A photograph in the cited report shows members in the tunnel.

SOURCE: GLITHERO, John, 2017, A visit to the site of Mellor Mill, Marple. *Newcomen Society Links* 243 (September 2017), 6–7.

### **Kingsway tram tunnel to be restored to its previous derelict state**

The Kingsway tram tunnel under Holborn in central London is set to be restored by Crossrail after it served an innovative purpose during the tunnelling work in the area. The long-disused tunnel once carried trams under Kingway from Embankment to Holborn. The tunnel was closed in 1952 and the southern end was adapted as a traffic underpass in 1964.

Untouched save for the occasional use in films and art installations, the northern end was recently taken over by Crossrail, as it offered a very convenient location for some of their works. During the construction of the large Crossrail crossover tunnel under Holborn, there was a slight risk of subsidence affecting buildings on the surface, and one way to avoid that is to pump grout into the soil above the tunnels to compensate for the missing soil down at the tunnel.

This compensation grouting needs a shaft to be dug down into the ground, and the Kingsway Subway came into service to provide a building site that had the advantage of not affecting road traffic above ground.



*Photo Ian Mansfield*

As the subway tunnel is Grade II listed, one of the conditions of allowing Crossrail to dig their tunnel was that they should restore the tunnel afterwards, and a planning application filed in mid-October has confirmed that they are now at that stage.

Now that the compensation grouting shaft has gone out of use the majority of the rings below ground are to be left in place, and the shaft will be backfilled, most

likely with lean mix concrete / PFA up to the level of the uppermost level of rings. These upper rings will be removed and the whole area backfilled with compacted crushed limestone and sand blinding to match the existing levels. The concrete floor of the tunnel will be reinstated with new concrete cast in-situ to replicate the appearance of the existing. Where setts and/or inspection covers have been removed beneath the concrete these will be reinstated as found.

Where granite cobbles (setts) have been removed, concrete will be laid over them once they are reinstated, in order to reinstate the floor of the tunnel as found. The iron tram rails will then be reinstated to their original locations. And the tunnel will go back to sleep once more. SOURCE: *Ian Visits* (website), 28 October 2017.

### **Commencement of Northern line extension tunnelling in March 2017, London**

Two 650-tonne tunnel-boring machines named Amy and Helen will excavate 300,000 tonnes of spoil in the creation of two 3.2 km tunnels extending the LU Northern line from Kennington to Nine Elms and Battersea. Tunnelling is expected to be completed by October 2017, with trains running from 2020. Spoil is going by barge to East Tilbury to create arable farmland in Essex.

SOURCE: ANON, 2017, Northern line tunnelling in March. *Modern Railways*, March 2017, page 22.

### **Tunnels network and power station under the City of London**

An electricity generating station, Citigen, owned and operated by E.ON since 2002, has been supplying current to City of London properties via a network of tunnels since 1992.

The station in Charterhouse Street, near Smithfield Market, supplies electricity and also chilled water for air-conditioning units via tunnels to places such as the Barbican Arts Centre, the Museum of London, the Guildhall, and the Peabody Estate. E.ON has recently upgraded Citigen, replacing two ‘unreliable and dirty’ ship diesel engines with smaller and cleaner gas-fired ones that came into service early in 2017. The power station roof had to be taken off and a tower crane employed to lift out the old engines and the huge diesel fuel tank.



*Part of the tunnel network. Photo Martin Godwin*

The combined heat and power plant also captures by-product heat from City buildings, and supplies chilled water to air-conditioning systems, as well as hot water for district heating schemes. Residential developments recently connected include the Blake Tower and Barts Square.

About half the distribution system is in pre-existing utilities tunnels ‘already crammed with power, communication and sewage pipes and cabling’. The rest is routed through basements, subways and underground car parks. Some new tunnelling has also been required.

SOURCE: VAUGHAN, Adam, 2017, Hidden City power plant fires hope for sustainable local supplies, *The Guardian*, 29 July 2017, page 29.

### First public tours of tunnels beneath Aylesbury

In October the Bucks County Museum in Church Street, Aylesbury ran a series of public tours of the tunnels below the town centre. This is the first time members of the public have been given access to the tunnels which are entered from beneath the museum. The eight 45-minute tours running between 25 and 28 October were quickly sold out.

The museum itself has an interesting history having originally been a monastery, then a private house and finally a school. Parties of twelve people were led through a door in one of the museum rooms down a set of modern steel steps into the basement.



The network of tunnels is surprisingly complex and some intriguing bricked-off parts have yet to be explored. Sadly the visitors were not provided with a plan and some accessible tunnels weren’t included in the tour and were only visible from behind a security grille. Given the season, the emphasis by the tour guide was on the spooky connections rather than the history and from the content it seemed clear that the guides didn’t actually know much about the history of the tunnels.

Visitors saw a capped well and some wine bins. Pipes and cables have now been routed along parts of the tunnel network. Further tunnel tours are planned for the spring. SOURCE: Roger Rowe (Sub Brit member).

### Public support reported for Bakerloo line extension to Lewisham, SE London

The proposed extension of the Bakerloo London Underground line from Elephant & Castle via Old Kent Road and New Cross Gate to Lewisham has been ‘strongly supported’ by Londoners. Extensions beyond Hayes have also been suggested.

SOURCE: ANON, 2017. Public back Bakerloo extension. *Metro*, 2 August 2017, page 28.

[See also: [tfl.gov.uk/bakerloo-extension](http://tfl.gov.uk/bakerloo-extension)]

### Draining and stabilising the Lyme Regis landslip, Dorset

Landslips, large and small, are common in England, and some occur in distinctly inconvenient places. During World War I, for example, the main railway line between the English Channel ports Folkestone and Dover was put out of use when the chalk cliffs at the back of Folkestone Warren slid into the sea.

Ventnor on the Isle of Wight is sited on a major slip, the western end of which has a long history of movement. And Lyme Regis is likewise at risk. At all three places relatively rocky cliffs slide towards the sea along slip planes developed in underlying clay. Rainwater penetrating the top of the slip tends to lubricate the slip planes.

At Folkestone Warren the movement of the landslip, and the railway, has been halted by two measures. Massive slabs of concrete were placed on the beach as ‘toe-weighting’ to prevent further rotational movement on the concave slip planes. And tunnels were driven inland from the beach to drain away the water which was lubricating the slip. Both features are readily seen.

The slip at Lyme Regis has been stabilised during the years 1990 to 2015. Draining water from the slip, as at Folkestone, has been amongst the methods employed, although smaller-diameter bored holes have been made instead of the mined walking-height tunnels used as in Kent. Instead of unsightly concrete slabs, at Lyme Regis a new sea wall, more acceptable to holiday-makers, has been built. And bored piles have been driven to anchor mobile rock beds.

SOURCE: MOORE, Roger, *et al.*, 2017, Stabilising Lyme Regis – a strategic approach. *Civil Engineering* 170 (2), 63–70.

### Progress towards agreement on the intended Stonehenge road tunnel, Wiltshire

A revised route for a longer road tunnel further away from the standing stones at Stonehenge now has Government support. Subject to planning permission being granted, construction of the new tunnel and realignment of the A303 as a four-lane highway could commence in 2021 and be completed in five years.

In favour of the new 1.8 mile tunnel now proposed is that the road will enter the east portal before the road reaches an important element of the wider archaeological



landscape called The Avenue, believed to have been a ceremonial approach to the stones. Visitors will, if the new alignment is accepted, be able to approach the monument in safety and tranquillity ‘for the first time in decades’.

SOURCE: MORRIS, Steven, 2017, Government redraws plans for Stonehenge tunnel. Route will be sited further from ancient monument. UNESCO concerns have not been addressed, say critics. *The Guardian*, 12 September 2017, page 13.

### Trans-Pennine road tunnels to be shortlisted

Five routes have been shortlisted for a new Manchester to Sheffield road, one of which would include a 29-kilometre tunnel under the Pennines. All five routes would join the M60 east of Manchester to the M1 north of Sheffield. Journey times between the two cities could be cut by thirty minutes.

SOURCE: DEPARTMENT OF TRANSPORT, 2016, Trans-Pennine road tunnel routes shortlisted. *New Civil Engineer*, October 2016, page 9.

### Proposal for motorways in ‘tunnels’, England

It is reported that Highways England is considering ‘tunnels’ made of pollutant-absorbing materials over selected motorways or main roads. Effectively, these would be elongated fabric tents, not of course true bored deep tunnels which for road traffic are notoriously expensive as a result of gross pollution by road vehicles. Some such ‘pollution tunnels’ made from material designed to absorb nitrogen oxides have already entered service in the Netherlands. Some trial pollution barriers are already in place alongside the M62 near Manchester. It has in any case been announced that it is intended to ban the sale of new diesel and petrol vehicles by 2040. The result of such a ban would be to relocate the pollution attendant on road vehicles from the roads to the factories where the vehicles are made and to power stations where electricity to serve the batteries is generated.

SOURCE: PATON, Graeme, 2017, Pollution tunnels to tackle car emissions. *The Times*, 3 August 2017, page 1.

### An overhead tunnel proposed for a fast ride from London to Edinburgh

Liverpool’s Overhead Railway tunnel was, as most *Subterranea Britannica* members know, actually underground. But proposals have emerged for a genuinely overhead (but without rails) tunnel from London to Edinburgh.

‘Pods’, each seating from 12 to 24 passengers, could be propelled along a vacuum tube between the two cities at ten-second intervals at sufficient speed to allow a 35-minute journey. Magnetic levitation would provide the required propulsive force. Solar panels on the pod roofs would provide some of the required electricity.

Members may notice that this scheme rather resembles Thomas Webster Rammell’s short-lived demonstration



*Magnetically-propelled transit pods for the Hyperloop on the California test track*

‘pneumatic railway’ at the Crystal Palace, operated in a brick tube built on the surface of the park for a few months in 1867, described in *Subterranea* 42 (September 2016), pages 53–59.

‘Hyperloop One’ is actually being actively considered for the 125-kilometre journey between Abu Dhabi and Dubai in the United Arab Emirates. A 1.6-kilometre 2-metre diameter test track in a vacuum tube in California is reportedly already constructed. A combination of linear induction motors and lack of air drag ‘will in theory enable the pods to reach close to the speed of sound’.

Pylons carrying the overhead tube could be erected above existing conventional railways or roads. The HypEd team working on the Anglo-Scottish proposal is ‘a multidisciplinary team of 50 students from the University of Edinburgh’s engineering, architecture, economics and business schools’.

There are some obvious ‘ifs and buts’ with this scheme, as there were with the short-lived ‘atmospheric railway’ actually operated in the early 1840s by the London & Croydon Railway. What about intermediate stops at York or Newcastle, for example, or junctions allowing ‘pods’ to diverge from the main line to serve Leeds? Would duplicated ‘out’ and ‘return’ tubes be required, or phased bi-directional running?

Perhaps London’s links with every major British city would need dedicated tubes, as would services linking those cities for direct travel between them. John Ruskin’s complaint that railway passengers were ‘treated like parcels’ come to mind. And if security screening as at airports and the Eurostar stations is anything to go by, one can imagine passengers being required to check-in at Edinburgh or London at least 30 minutes before departure, more or less doubling the proposed journey time!

SOURCE: ANYSZEWSKI, Adam, and Carolina TOCZYCKA, 2017, Edinburgh’s hyperloop team predicts a transport revolution. *Civil Engineering* 170 (2), page 51.

## Two new underground stations and rail tunnel under Stockholm, Sweden

Members who were in Stockholm with us a year or two ago will recall visiting the Citybanan tunnel under that city during construction. The new tunnel is six kilometres long and includes immersed tube sections under water, and bored rock tunnels under dry land. Passenger trains commenced running on 10 July 2017. The Citybanan was created to relieve pressure on the very busy Central Station in the city.

SOURCE: ANON, 2017, Stockholm Citybanan opens. *Modern Railways* 74 (828), page 83.

## Tunnel collapse closes Europe's busiest international rail line, Germany

From 2016 two parallel single-bore tunnels have been under construction below the town of Rastatt as a part of a new High Speed line to carry one of the heaviest traffic flows on Europe's railways. The tunnels are to allow through trains to by-pass Rastatt.



*By sheer bad luck, the tunnel collapse happened at the only point the new 4.27km long tunnels cross under the existing line and significant earth movement on the surface resulted*

On 12 August 2017 a fifty-metre unfinished section of the eastern tunnel bore collapsed, trapping the tunnel-boring machine (TBM). To make matters worse, the collapse occurred at shallow depth, about five metres, below the

old line still in use, resulting in a 150-metre stretch of the existing line being affected by subsidence. All traffic, over 150 passenger trains and up to 200 freight trains a day, has had to be rerouted temporarily via alternative lines.

The route in southwest Germany carries international trains on the Karlsruhe to Basel line to and from, for example, France and Switzerland. The TBM is being dug out! The tunnels are bored in relatively soft rocks, using ground-freezing (probably with liquid nitrogen) to provide a reliable and consistent material for the machine's cutting teeth. Failure of the ground freezing appears to have allowed groundwater to flood into the affected tunnel, assisted by heavy rain.

SOURCE: FENDER, Keith, 2017, Tunnel collapse closes Europe's busiest international line. *Modern Railways* 74 (829), 76–77.

## The world's deepest sub-surface railway station, China

The world's deepest railway station is being constructed 432 metres (1,417 feet) below the Great Wall of China. It will be within the 12 kilometre (7 ½ miles) Badaling tunnel on a new high-speed rail line from Beijing to Zhangjiak, a destination scheduled to be one of the host cities for the 2022 Winter Olympics. The subsurface station will have an area of 36,000 square metres and be built on three levels.

SOURCE: ANON, 2017, Chinese build deepest rail station. *The Times*, 3 August 2017, page 36.

## The fourth cross-harbour rail tunnel at Hong Kong.

There are already three rail tunnels carrying trains under the harbour at Hong Kong, now to be joined by a fourth, due to be completed in 2021. This is to be a 1.4 km immersed tube tunnel constructed of concrete box sections laid in a trench across the sea floor. The tunnel will have two passages for rail tracks and, alongside, a smaller ventilation duct.

SOURCE: AU, Raymond, *et al.*, 2017, Planning and procuring the Shatin–Central cross-harbour rail tunnel, Hong Kong. *Civil Engineering* 170 (2), 71–79.

## Chislehurst 'caves' revisited, SE London

The extensive chalk mines at the bottom of Old Hill, Chislehurst, have been operated as a tourist attraction for over a century, currently open Wednesdays to Sundays inclusive, with 45 minute guided tours every hour on the hour from 10.00 to 16.00. Hand-held oil lanterns (about one to every four or five persons) are issued by the guide (taking in your own lamp and photography underground are forbidden). Although current publicity for the 'caves' and a booklet on their history by the late Eric Inman, on sale there, portray them for what they are, abandoned chalk mines, the cave guide leading a recently attended public tour presented all the old nonsense about twenty miles or more of tunnels dating back 4,000 years or so, druids' sacrificial altars, a ghost, and a claimed 'iguanodon' fossil

in the ceiling. In fact the tunnels are primarily of interest for their secondary uses, namely roles in World War I (explosives storage) and World War II (air-raid shelters) and as a defunct mushroom farm and subterranean tourist attraction. Details of opening times and prices can be had at (T) 020 8467 3264 or [www.chislehurstcaves.co.uk](http://www.chislehurstcaves.co.uk). The proprietors are Kent Mushrooms Ltd, although none have been grown since before World War II!

### References

CHEESEMAN, Jill, nd, *Chislehurst Caves: a child's wartime memories 1939 – 1945*. Chislehurst: Kent Mushrooms Ltd: 16pp [on sale at the caves]  
INMAN, Eric R., 1996, *Chislehurst Caves: a short history*. Chislehurst: Kent Mushrooms Ltd: 11pp [on sale at the caves]





# Collyweston Slate. At last, the light at the end of the adit

Terry Hughes



*Brock-100 mounted remote-control jack hammer operating in Claude Smith's reopened mine at Collyweston*

*The Lordship of Colly-Weston has afforded, and is still capable of affording, a great Quantity of Slatestone. They dig the like Slatestone in good plenty at Easton, and might do the same at Dudington .... So that this part of the County is plentifully stock'd with it; so plentifully, that even the meanest Houses of the Towns and villages hereabouts are slated. A safe, strong, and durable Covering it is, and so white and fine, when new especially, that in a bright Day it very pleasingly affects the Eye of a Traveller that has one of the Towns thus slated in his View.*

J. Morton 1712, *The Natural History of Northamptonshire with some account of the antiquities*. London, R. Knaplock and R. Wilkin

In 1286, on the order of Edward I and probably at the instigation of the formidable businesswoman, his wife Eleanor, Collyweston slates were used to roof Cambridge Castle. Known as slatestones of Peterborough in recognition of their shipping point on the River Nene, this is an early record of an already well established industry – there is archaeological evidence of Roman use – which was to thrive during the next six hundred years but faltered in the late twentieth century.

It was in the 1980s when I worked at Penrhyn slate quarry in North Wales that I first became involved with efforts to regenerate production of this important vernacular product.

## **Geology and Meteorology**

Collyweston slate is not slate in the geological meaning. Rather it is a fissile sandy limestone which is susceptible



to being split into thin sheets by frost action. (above)  
The traditional production process was to extract the fissile stone known as 'log' and store it until there was the promise of a frost. It was then laid out in the fields and kept wet day and night until the layers were opened. (next page)

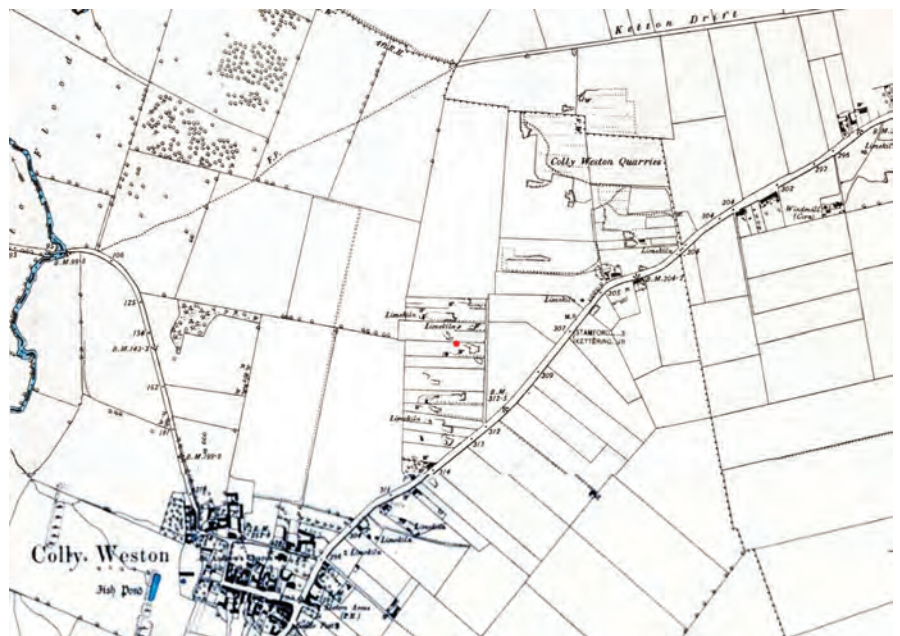


Once separated the process was completed with a cliving hammer producing stone sheets a few millimetres thick suitable for roofing.

It was this reliance on the natural frosts which resulted in a serious decline in output from the middle of the twentieth century when there had been a series of mild winters. This, together with the advent of fake Collyweston 'slates' made of concrete, resulted in mining almost ceasing. It had been long recognized that if an artificial frosting process could be developed this might save the industry and the many historic roofs which were being lost.

Some frosting trials had been attempted by the Burghley Estate but were unsuccessful. The Estate had many Collyweston roofs in need of repair along with a disused mine so they were keen to foster production. In the late 1980s they asked Penrhyn Slate if we could help.

At that time there was a supply of log available from an aggregates quarry operated by the Bullimore brothers at Duddington, a few miles from Collyweston. There was a planning condition that any log, which was at the lowest level of the excavation, must be made available to anyone wanting to make slates. (below)



But it still relied on natural frosts and wasn't sufficient to satisfy demand.

Burghley's proposal was that a frosting process should be jointly developed to use this log but after researching the market and the potential for production Penrhyn, a 50,000 tonnes of roofing slates a year operation, concluded that the prospect was too small for us to become involved.

Five years later I had left Penrhyn to become an independent roofing consultant and was retained by English Heritage's (now Historic England) Building Conservation and Research Team (BCRT) to facilitate vernacular slate and stone roofing production and to advise on historic roof conservation. It was in this role



This was producing a small amount of slate, mainly through the efforts of a Collyweston slater, David Ellis. (top right)

that the BCRT and I fielded over many years a series of initiatives by Collyweston enthusiasts to try again to re-establish production. In spite of much effort on our part these came to nothing and by the early 2000s production had almost ceased.

By the 2000s although there were still plenty of old mines with good log, mining had completely ceased and the only source of new slate was the small amount being produced from the Duddington quarry. (map above)

### The Slate and its production

Collyweston log lies at the base of the Lower Lincolnshire Limestone in the Middle Jurassic and rests on a bed of compressed sand. (top of next column)





The earliest extraction was probably by surface workings from the sloping land along the River Welland but once these were exhausted mining was developed. Production actually took place over a wider area than just at Collyweston, for example up to fifteen miles away around Corby. (below)



This stone was also used to build walls along the tunnels behind which the excavated sand was dumped. The slaters were very adept at recognizing good fissile log and following it. This resulted in meandering tunnels but meant that little or no waste material had to be taken out of the mine.



Once a suitable mass of log was undermined – about 20 tons' worth – the props were knocked out and the log allowed to fall. If it didn't immediately drop, wedges were driven in to loosen it. Having to do this in the narrow tunnels meant that the slater was standing very close to the log as it all came crashing down .... and blew out all the candles.

The rock which had been dropped wasn't all suitable for slates so the next step was to separate the upper part known as 'bastard' with chisels.

Access to the productive beds was normally down a shaft with a winch to remove the log. Tunnels were then driven under a strong natural roof to suitable rock. Advantage was taken of the sand bed by undermining it with a pick – known as foxing, to a width of about twelve or fifteen feet. This would take one or two weeks, working lying on your side. (below)



As the undercut advanced the log was propped on pillars of waste stone ('deads') from previous workings.

This went to make the pillars and walls. The good log was stored underground until the winter when it was broken into pieces which could be barrowed out and carried into the fields for frosting. From now until the frosting was well advanced the log had to be kept wet or it would lose its fissility; a cold and unpleasant job which went on day and night.

Once frosted, the log is split, or ‘clived’, to use the local term, with a cliving hammer. This is similar to a brick hammer at one side to dress the slate’s edges and with a jaw at the opposite side which can break away larger pieces to square up the sides.



Only the bottom edge and two sides are squared, the top being left ragged. This maximizes the amount of slate which can be made and is satisfactory on the roof because the two top corners are not in the area into which water can spread – provided the slates are arranged correctly on the roof.

The slates were sold in a mixture of sizes from about 24 to maybe four inches long.



They have traditional names which were originally intended to confuse non-Collyweston roofers and protect the market. They are laid on the roof with the largest at the eaves and grading down to the smallest at the ridge.

### Collyweston slate names and lengths

Ridge

Anything under 6” is called an outrule

- 6” even mope
- 6½” large mope
- 7” even mumford
- 7½” large mumford
- 8” even job
- 8½” large job
- 9” even short-un
- 9½” large short-un
- 10” even long-un
- 10½” large long-un
- 11” even shortback
- 11½” large shortback
- 12” even middleback
- 12½” large middleback
- 13” even longback
- 13½” large longback
- 14” batchelor
- 15” wibbett
- 16” twelve
- 17” fourteen
- 18” sixteen
- 19” eighteen
- 20” in-bow
- 21” out-bow
- 22” short ten
- 23” middle ten
- 24” long ten.

Eaves

### Historic England and Apethorpe Hall

By the dawn of the 21st century the situation for the conservation of historic Collyweston roofs had become very serious. Many buildings were losing their roofs to concrete fakes and it was becoming accepted that the back slopes of buildings could be changed to some other covering so that the available slates could be used on the more visible front slopes.

Farm buildings were particularly at risk; often with no purpose in modern farming, they were often stripped and corrugated sheets substituted. Slaters would even offer to replace a whole barn roof free of charge just to get the slates for another building; a thoroughly unsatisfactory situation.

Coincidentally, Historic England was going through the drawn-out process of trying to save Apethorpe Hall from neglect by its owner. (top of next page)

This Grade 1, fifteenth-century house once owned by Elizabeth I had previously been an approved school and





subsequently had stood empty for many years. The roofs in particular were deteriorating.

In an attempt to protect the interior of the Great Hall, the caretaker had had to resort to removing thermo-plastic tiles from a floor to use them as slates to repair a hole in the roof. Eventually it became clear that the only solution for the hall was compulsory purchase; this was the stimulus that was needed to finally resolve the slate supply problem.

While the Apethorpe Hall purchase process had been taking place, English Heritage's BCRT had commissioned research into a frosting process by their stone consultant David Jefferson and Sheffield Hallam University's Department of the Natural and Built Environment. This produced a design for the process and using log from Bullimore's quarry this was successfully trialled at Apethorpe following its compulsory purchase.



Once the technique had been refined it was made freely available to anyone wanting to use it. It was taken up by two companies: Messenger Construction who had carried out the trials at Apethorpe; and Claude Smith, Collyweston Slaters in their own mine.

### Claude Smith. Getting down to business

Claude Smith had operated their mine at Slate Drift, Collyweston until the 1980s. By 2014 it was clear that if the roofing business was going to have a long-term future they would have to secure a supply of new slates. So they began the process of reopening the mine. From the start it was obvious that this was going to have to be operated in a different way from the traditional system; no more lying down under twenty tonnes of rock for weeks on end.



Their consultants developed an operation based on access along an adit following the fall of the deposit rather than a ladder; this would allow mechanical equipment to be brought in to do the hard work. Safety was an important issue of course – the roof would be supported on real masonry not piles of stone and the old access tunnel and shaft would be an emergency exit.

A planning application was prepared which included noise and working time limitations and alternative roosts for bats in an older tunnel. Waste rock and sand would be placed in worked-out tunnels so there would be no surface impact of the mining.

Excavation of the adit took a few months but now the extraction process is continuous using a Brock-100 mounted remote-control jack hammer which undercuts the sand and then brings down the log in pieces rather than in one 20-tonne block.



This is then removed with a small front-end loader and stored in tanks of water ready to be frosted in a commercial freezer unit. Before frosting the water is drained off.



The product is frosted for 24 hours at about -13°C although all that is needed is to just reach the temperature at which the anomalous expansion of water opens the

layers, and then returned to the water for a good soak. This is repeated once or twice until it's ready for cliving. From there on the finishing still follows the traditional method. The frosted log is clived with a hammer or hammer and chisel and the edges are squared and dressed by hand.



The hand dressing is especially important because the look of the edge is one of the most important features of an authentic Collyweston roof.



Although it is tempting to use a cheaper method (such as using a clipper saw) the square edges this produces would never be acceptable for listed or other buildings in conservation areas.

### The Future

It has taken nearly three decades to re-establish production but now there is no reason why this important feature of the East Midlands roofscape and beyond cannot continue indefinitely. Several important roofs have already been



conserved and slates are being stockpiled for Bodley Court at King's College, Cambridge.

The saving of Collyweston slates exemplifies how without commitment from a national organization with the resources to take on what is inevitably a risky proposition, in this case Historic England and its Building Conservation and Research Team, a project is unlikely to succeed no matter how enthusiastic local people are about their heritage. Irrespective of how much the conservation of buildings is supported by legislation and grants, without a supply of the materials from which they are built they will be lost.

Many building materials can be obtained from almost anywhere. You could, for example, grow the oak trees you need for a roof structure anywhere, but specific stone essential for much vernacular architecture can only be obtained from where it occurs naturally.

**Editor's note:** Collyweston is a village in northeast Northamptonshire, close to the borders with Rutland and Lincolnshire.

## Subsurface lavatories at Gasr El-Heneia, Libya

Possibly the oldest recorded rock-cut underground 'conveniences' were discovered at what may be Roman period 'fort' in or about 1950 at Gasr El-Heneia in Libya. These were recorded in the rock-cut basement below the roughly constructed 'fort', interpreted as of possibly Roman period but constructed by native Libyans of the day. Steps lead down to a space in the rock-cut cellars about six or seven metres long and 1.5 metres wide, at the end of which were found two recesses, one on each side, equipped with one-hole stone slab seats. Each recess had a niche presumably to place a lamp, a latrine pit covered by

a stone slab, and possibly a ventilation shaft. No evidence was seen for 'modesty curtains'.

A short article in a recent issue of *Current Archaeology* (296) notes that although 'many examples of stone and marble bench seats for latrines are known across the [Roman] empire' the first recorded Roman wooden toilet seat has just been discovered at the Vindolanda fort on Hadrian's Wall. SOURCE; GOODCHILD, R.G., 1951, 'Libyan' forts in south-west Cyrenaica. *Antiquity* 99 (September 1951), 131 – 144 + plates i – iv.



# Glenfield Tunnel, Leicester

## Visit in July 2017

Chris Gray



*Reinforced concrete hoops used to reinforce the tunnel in places of weakness by Leicester City Council. Photo Ade Armishaw*

A small group of members visited the Glenfield Tunnel on Saturday 15 July, when a tour was held by the Leicestershire Industrial History Society, who manage the tunnel on behalf of its owners, Leicester City Council. Glenfield was a village, but is now a suburb to the west of the city.



*The Sub Brit party prepares to enter the surviving west portal of Glenfield tunnel. Photo Ade Armishaw*

This was a rare opportunity to see one of the earliest railway tunnels in the UK – built by George Stephenson in 1832 as part of the Leicester & Swannington Railway whose principal engineer was Robert Stephenson. Its genesis was the result of the frustrations of the northwest Leicestershire coal mines being unable to compete with their Nottinghamshire and Derbyshire rivals who had access to canal navigation.

George Stephenson (1781–1848), known as the ‘Father of Railways’, was engineer for the Stockton and Darlington Railway. He and his son Robert were the leading figures of the new age of railways; in 1829 they had designed and built *Rocket* for the new Liverpool–Manchester Railway.

### Canal runs out of water

A previous venture to provide practical transport, the Charnwood Forest Canal, had been a failure, partly because it was necessary to transfer the coal to a horse-drawn waggonway for part of the journey between two sections, but more so because of the disastrous collapse of the Blackbrook reservoir dam in 1799, which emptied the canal and caused extensive flooding.



*Glenfield tunnel overlaid onto a modern map. The 13 ventilation shafts are shown*

The local landowner John Ellis had heard of George Stephenson's success in the north of England, and approached him to see if he thought a railway linking the mines with Leicester would be possible. Stephenson surveyed the area, and noted several problems with gradients. His solution at one end of the line was an inclined plane at Bagworth, driven by a stationary engine (this is now preserved in the National Railway Museum at York).



*The now buried east portal in June 1965. Photo Bill Wright*



*Looking west along the tunnel. Photo Ade Armishaw*

At the other end of the line between Gilroes and Glenfield, a rise and fall in gradient would have necessitated two inclined planes, which would have been extremely impractical, and so Stephenson chose instead to build a tunnel.

This was a really risky proposition. Many canal tunnels had been built in the previous decades, but railway tunnels were a different thing altogether, requiring greater height and width. Stephenson had built only one previous railway tunnel – on the Canterbury & Whitstable line – but this was less than half a mile long as opposed to the one mile and 36 yards required at Glenfield (plus approach cuttings both ends).

Construction proved to be problematic. Boreholes had been sunk, but these probably did not go to sufficient depth, and the assessment that the tunnel could be bored in relatively favourable ground proved to be erroneous. A large percentage of the tunnel had to be bored through running sand, which increased the cost considerably, and wooden shuttering was required to keep the sand at bay whilst the brick lining was constructed.



*Looking out of the west portal in June 1965. Glenfield station (closed 2 September 1928) is seen in the distance on the left. Photo Bill Wright*

Originally a brick lining had not been envisaged, and as it became clear that this was a necessity, the question of where to obtain the required bricks arose. There is not an accurate record of the number used, but it is estimated that it is over five million, and it seems likely that these





were made on site from clay from Thomas Pare's estate. In the more vulnerable places, the brickwork is between 14 and 18 inches thick, which is several courses deep. Tunnel construction was made by digging from each portal, and from four large shafts which survive today, along with a further ten shafts, which may have originated as trial boring shafts. Several irregularities in brickwork can be seen where separate sections join.



*Looking west along the tunnel. Photo Ade Armishaw*

The final cost of construction was around £17,000, some £7,000 over the original estimate, and well over a million pounds in today's terms. Originally the tunnel portals were to have Moutsorrel Granite facings, but these were actually completed in brick, presumably because of the cost overrun.

The success of the Glenfield tunnel can be judged from the fact that it operated continuously from its opening in 1832 until its closure in 1966. The line carried passenger traffic until 1928, and there was a station adjacent to the Glenfield portal.



*Glenfield Station and the west portal of Glenfield Tunnel c1905. Photo from John Alsop collection*

After closure, British Rail made a number of attempts to sell the tunnel to no avail, but it was briefly leased by Marconi who used it to develop a laser system.

Leicester City Council eventually acquired the tunnel for a peppercorn price of £5, principally to allow them to develop the land to the east of the tunnel.

A housing estate was duly built, necessitating the infilling of the approach cutting at the Gilroes end, and the tunnel portal was buried. Access at this end is now only via a manhole and shaft.

### **Collapse in Kent**

In July 1974, part of the former Canterbury & Whitstable Railway tunnel collapsed, taking part of the University of Kent's Cornwallis building with it. Since this was a Stephenson tunnel of similar vintage to Glenfield, fears about the latter's stability were raised at Leicester City Council, and a thorough structural survey was commissioned.

The result determined that the tunnel was generally in satisfactory condition; however, there were areas where distortion was evident due to ground movement. A system of reinforced concrete hoops was chosen to reinforce the tunnel in places of weakness, and these were cast in 31 places throughout the tunnel's length. This work cost the City Council in excess of £500,000.



*One of the ten surviving ventilation shafts. Photo Richard Griffin*

After we had visited the tunnel itself, we spent the rest of the afternoon walking the route on the surface to visit the surviving ventilation shafts. Ten of the original thirteen survive, and are all now listed Grade II. One was unfortunately illegally demolished by a developer in the 1990s, but has been rebuilt in a vaguely sympathetic style. As almost all of the area over the tunnel was developed from the 1930s onwards, most of these shafts are now in private gardens; however some remain on public land. Thanks are due to David Lyne and his colleagues of LIHS for a very informative visit.

## Subterranea Britannica

# Notice of Annual General Meeting 2018

**The AGM will be held on Saturday 14 April 2018, commencing at 10.00am  
at the Royal School of Mines, London, in association with the Spring Meeting.**

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Attendance is open to all current members of Subterranea Britannica.

Documents for the AGM will be available on our web site at [www.subbrit.org.uk](http://www.subbrit.org.uk)  
at least 28 days in advance of the meeting. An email will be sent to advise this.  
Documents will be sent to those members who have registered to receive them by post.

Minutes of the AGM 2017 were printed in *Subterranea* Issue 45, September 2017.

\*\*\*

## Spring Meeting 2018

**Saturday 14 April, commencing at 10.25am,  
Royal School of Mines, London SW7 2BP**

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There will be the usual mix of interesting illustrated talks along with Members' contributions  
and a chance to meet and mingle with fellow enthusiasts.

\*\*\*

Speakers will be advised via the website, once confirmed.

\*\*\*

Booking will be either via the website at [www.subbrit.org.uk/events](http://www.subbrit.org.uk/events)  
or by post to our registered address. Please make every effort to book in advance,  
as latecomers make logistics and catering difficult.

Non-members are very welcome to attend.

**Cost for AGM and Spring Meeting is £20, to include a sandwich lunch.**

**No charge for attendance at AGM only.**

**Please put the date in your 2018 diary now!**



# The Road Tunnels of Great Britain

Mark Chatterton



*The Park Tunnel in Nottingham showing the light well and steps up to street level*

My interest in road tunnels stems from an early age when I can remember travelling through the Mersey Tunnel (as it was then known) between Liverpool and Birkenhead. There was something magical for a young boy to be transported by car, starting in one place, then go underground into a strange tunnel and finally emerge a few minutes later in a completely different place.

Since then, over the course of my life I have managed to gain an interest and knowledge of the road tunnels of Great Britain. For the last ten years I have diligently travelled the length and breadth of the country seeking out new tunnels to photograph and of course travel through. From my researches I have identified approximately fifty major road tunnels that have their own name and can be found on major roads in Britain. However there are at least another hundred road tunnels spread throughout Britain, some of which I will discuss in this article. As you would expect, London has by far the greatest number. In fact, starting with a central point at the Tower of London, there are no fewer than twelve road tunnels within a ten-mile radius from here.

Kent is the county with the most road tunnels – I have managed to identify ten at the last count. Though of course road tunnels can be found in most of the major cities of Britain including Glasgow, Leeds, Manchester, Newcastle, Bristol, Birmingham and Liverpool.

## **Twice into Print**

Last year I published a short book entitled *British Road Tunnels – An Introduction*, which gave a brief look at some of the country's finest. Later this year I will be bringing out a full volume on British road tunnels entitled *The Road Tunnels of Great Britain*, which aims to list every road tunnel there is in Britain, as well as give information on them, such as their history, building methods used and measurements of the most important ones.

Before I start looking at some of the various and more unusual road tunnels in Great Britain, I will explain how I define a road tunnel. For this article, I would define a road tunnel as one that has been built over a public road to carry vehicles, primarily cars, to go under a hill, building or other obstacle.



As to what constitutes a tunnel, that is a harder question to answer. The Department of Transport has their own definition of a road tunnel which says that it should have a minimum length of 150 metres (164 yards). That covers most of the major road tunnels in Great Britain such as the Dartford, Clyde and Tyne Tunnels, and the A3 tunnel at Hindhead.



*View of a modern road tunnel at the Marina, Brighton.  
View looking north, away from the Marina.  
Photo Wendy Chatterton*

However, there are many shorter road tunnels which go under buildings, airport runways and railway lines for example, which most people would agree are tunnels. Most people would define a tunnel as an underground passage which is longer than it is wide. Some larger bridges might meet this definition, so I would say that for a road tunnel to be included in this article, it should be a least ten yards long – the reason why will be revealed later in this article.

To be fair, every person has their own view of what constitutes a road tunnel, but generally speaking most people recognise a road tunnel when they see one. I shall leave it there, but no doubt there will be some who might disagree with this.

Going back in time to the first road tunnels, I have managed to identify three which are still standing – all of them in the south of England.

The Reigate Tunnel is said to be the oldest road tunnel in Great Britain, opened in 1823 before most railway tunnels had even been thought about. Reigate, a small town situated on the southern edge of the North Downs in Surrey, was the home to John Somers Cocks, 1st Earl Somers, who owned a large house on top of a hill, where Reigate Castle had once stood.

The main road to London (A217) was to the north of it and the town centre was to the south of it. The construction of the tunnel meant that traffic no longer had to go round the hill, but underneath it. It stayed that way until the 1970s when the tunnel was closed to road traffic and traffic was once again diverted round the edge of the hill, the reason being that the tunnel was far too narrow for the ever-increasing levels of two-way traffic.



*View into Reigate Tunnel from the north*

### **Tunnel Beer Festival**

However, the tunnel is still open for pedestrians and cyclists to use. There is even an annual beer festival held on the roadway. Plus there are some doorways inside the tunnel which lead to the Tunnel Road Caves – a labyrinth of caves which were originally carved out to produce silver sand. They were used as storage areas for wine and other goods, and as shelters in World War II.

They are well worth a visit and have open days several times a year (see *Subterranea* 38, April 2015 page 4). Visit [www.reigatecaves.com](http://www.reigatecaves.com) for dates in 2017/18.

Moving further west to the county of Dorset, there are two more road tunnels which were built in the 1830s. The Beaminster Tunnel, as it is commonly known, is found to the north of the village of the same name on the A3066 and is the oldest road tunnel still open to traffic today. It was first opened in 1832 as an easier route under Horn Hill. It originally carried a toll road underneath the hill until 1881, when the toll gates were to drive through, with its narrow carriageway and high roof. The tunnel, due to its age and freak weather conditions, has had to close for repairs several times after collapses. These were in 1968, 2009 and 2012, the last leading to the deaths of two people travelling through the tunnel at the time (*Subterranea* 35, April 2014 page 19).



*A view from inside the Beaminster Tunnel, looking south.  
Note the narrow carriageway and high roof.  
Photo Wendy Chatterton*

The other road tunnel in Dorset is the one known as the Charmouth Tunnel, being situated about two miles north of that village. It was also built in 1832 and until 1991 was part of the A35, but a new by-pass led to its being abandoned for several years. Then in 2004 the tunnel area was purchased by a sports company and converted into a shooting range, opening in 2010.

Another early road tunnel (which I found out about through reading the *Sub Brit UK Site Directory*) is the one in Nottingham known as the Park Tunnel. It was originally a road tunnel when it was first opened in 1855, connecting the large municipal park in Nottingham with the Derby Road which led to the city centre.

It is now a public footpath, with the northern entrance lost inside a modern building, but is still worth a visit if you are ever in Nottingham, especially for its size and striking sandstone sides. Also in Nottingham are the Nottingham Caves under the Broadmarsh Shopping Centre and the Nottingham Rock cemetery (see our *UK Site Directory* for more details).

### More Golden Oldies

There are two more road tunnels over a hundred years old which are still open to road traffic in Britain. They are the original Blackwall Tunnel, which opened in 1897, and the Rotherhithe Tunnel, opened in 1908.

They are both in the east of London and were originally built to carry goods between the docks on the north and south banks of the river Thames. They both have the feature of being built with sharp bends at either end, hiding the proverbial light at the end of the tunnel. This is allegedly to prevent horses from bolting on seeing the distant light at the exit!



*Southern portal of the Rotherhithe Tunnel taken from the pavement which runs all the way through. Note the inscription above the arch: This tunnel constructed by the London County Council was opened by H.R.H The Prince of Wales K.G. on the 12th June 1908. Maurice Fitzmorris C.M.G. Engineer*

What is unusual about the Rotherhithe Tunnel is that pedestrians are still welcome to walk through the tunnel if they so wish. Today it is reckoned that around twenty people a day still do so on their way to and from work, though with a 20 mph vehicle speed limit, face masks are recommended! (Pedestrians were also allowed to walk

through the Blackwall Tunnel until the 1970s when levels of traffic and safety concerns led to its being stopped.)

Incidentally, passing underneath, just a few yards from the southern entrance to the Rotherhithe Tunnel, is Brunel's famous Thames Tunnel, which should have been the world's first *road* tunnel under water.

When it was finally opened after many setbacks in 1843, it was a pedestrian-only tunnel as the cost to build shafts for the horses and carriages that should have used it was too much. Today it is part of the London Overground train system – a rather ironic name seeing as this section is underground!

### This Bit is Boring

Perhaps now is the time to briefly mention the various methods used to build road tunnels. For the above tunnels built in the 1800s, the most common method was to dig out the earth with picks and shovels and then use bricks to line the tunnel. This boring-out of a tunnel is still common today, but giant boring machines are used instead of manual labour.

Another common method still used today is the “cut and cover” method. Here a trench was dug out and the resulting space was eventually covered over to create a tunnel. For example, the Chestfield Tunnel on the A299 Thanet Way in Kent which goes underneath the Chestfield Golf Course, with just two metres of earth covering the tunnel.

A more recent method is the Immersed Tube Method which is used for tunnels which go under water. A trench is made along the river bed, then a series of concrete tubes, which are built elsewhere, are floated along the river and lowered into place. The remaining space in the trench is filled in and the river bed reinstated. The Medway Tunnel in Kent and the Conwy Tunnel in North Wales are examples of this type.

Finally there is the New Austrian Method which was first developed in the 1960s. Initially, it is the same as boring, with quick-drying concrete sprayed all round the edges of the cut hole to stabilise the rock above and around it. Rock bolts and wire mesh may also be added for extra stability, particularly where the rock/soil is quite soft. The only example of this method of tunnel construction in Britain as far as I know is the Southwick Hill Tunnel on the A27 near Brighton in West Sussex.

Another interesting fact about some road tunnels is that they were once railway tunnels and have since been converted to be used by motor vehicles. I have managed to find three such tunnels, though all of them are nowhere near any centres of population.

They are the Swainsley Tunnel near the village of Ecton in Derbyshire, the Spittal Road Tunnel near Fishguard in South Wales and the Pinnock Tunnel near Par in Cornwall. The latter is now used as a route for china clay lorries to get to the docks at Fowey from Par. Although it is privately owned there are days when the tunnel is open to the public and you can either ride your bicycle through it or take a ride on a golf buggy.



*The eastern bore of Southwick Hill Tunnel looking west. It was opened in 1996 and is 490 metres (1608 feet) in length. Interestingly enough, some conspiracy theorists believe this tunnel contains an entrance to a secret military base due to its proximity to several other former military bunkers. [www.theargus.co.uk/news/362516. Southwick Tunnel is secret military installation]*

There is an interesting road tunnel in central London which was formerly used by trams. This is the Strand Underpass (or Kingsway Tunnel according to some), which was opened to road traffic in 1964. Before that it was part of the Kingsway Tramway Subway.



*A lone motorcyclist emerges from the southern portal of the Strand Underpass going north. During the 2012 London Olympics the usual one-way system going north was reversed to help with the traffic flow*

It is quite a narrow one-way tunnel and starts at the northern end of Waterloo Bridge, going under the Strand and coming out in Kingsway. The northern part of the tunnel is still closed to traffic (and pedestrians) and comes out in Southampton Row, where you can still see the original tramlines behind gates. This end was temporarily opened in 2009 when an art installation called *Chord* took place in the normally closed section.

### Motorway tunnels

What about modern tunnels in Britain? There are plenty

of them, perhaps more than most people realise. I would put them into five categories: road tunnels on major roads; under airport runways; under railway lines; under shopping centres, and tunnels that don't fit into the other categories.

In the first category I would include the Bell Common Tunnel on the M25, near Epping in Essex. It may come as a surprise but this is just one of a handful of road tunnels on Britain's motorways, with most of them being situated in the southeast.

The Bell Common Tunnel is the only major road tunnel in Essex and is just one of two road tunnels on the M25, the other being west of Waltham Abbey. (For those who think the Dartford Tunnels are on the M25, think again! They are actually on the A282 as the M25 is not a complete motorway, but begins and ends on either side of the Dartford Bridge/Tunnels.)



*The anti-clockwise carriageway of the M25 as it enters the westbound Bell Common Tunnel. Note the sign showing the length of the tunnel in yards. Photo Wendy Chatterton*

This tunnel is perhaps the busiest road tunnel in Great Britain with over fifty million vehicles passing through it each year. It is also one of the widest with four lanes plus a hard shoulder running through each bore. As it is situated under part of Epping Forest, a tunnel as opposed to a cutting had to be built, due to ancient laws governing building on Epping Forest land. In fact the whole site was dug up anyway using the cut and cover method.

There is now a cricket pitch, belonging to the Foresters Cricket Club, directly above the tunnel. An interesting fact is that at either end of tunnel there are signs with the name of the tunnel on them, with the length of the tunnel given in yards as opposed to metres!

There are several road tunnels at many of Britain's airports which usually go under runways and buildings. Probably the best known is the one at Heathrow Airport called the Heathrow Link Road Tunnel or Heathrow Main Tunnel. It is the oldest of all the airport tunnels and runs south from the Heathrow Spur roundabout on the M4/A4 interchange straight into the original airport terminal area. It was opened in 1957 and contains four tubes; in 2016 it underwent a complete refurbishment to cope with heavier planes and new safety rules.

Other tunnels at British airports include those at Gatwick, Manchester, Luton, Exeter and Leeds Bradford airports.





*A view of the northern portals of the Heathrow Link Road Tunnel. There were road works taking place in the two outer tunnels when this picture was taken in 2014*

Most are open to traffic, but there are some road tunnels which are airside only and off-limits to the general public, including some at Heathrow and Gatwick airports.

### **Underneath the Arches**

There are many more tunnels that can be found under railway lines that are often hidden from the casual traveller, but are well known to locals. These are where there are several lines of track running parallel to each other, usually on a viaduct outside a main station. Underneath you will find businesses built into the arches, as well as many through roads creating tunnels.



*View of the Bermondsey Street tunnel under London Bridge railway viaduct, taken in 2012 before all the reconstruction work in the vicinity*

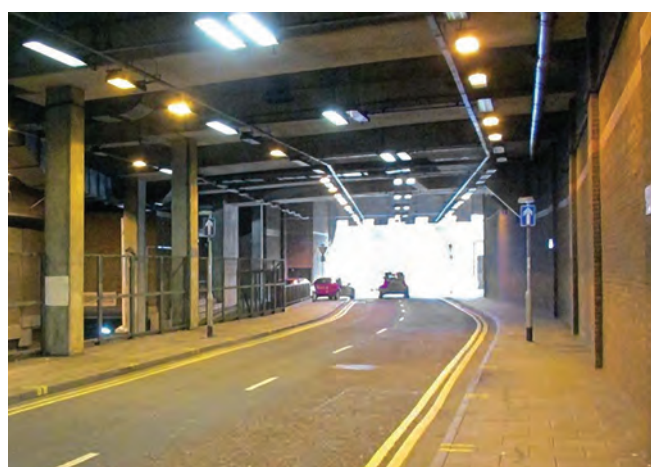
The best known examples are both in London under the long viaducts leading from London Bridge and Waterloo stations. In recent years London Bridge station has been completely rebuilt and the former road tunnels of Stanier Street and Weston Street have now been merged into the new station. However if you care to walk down Tooley Street away from London Bridge station you will come to several more shorter road tunnels under the wide viaduct that heads southeast from London Bridge.

It is the same with London's Waterloo station where several road tunnels have been built under the wide viaduct that leads from Waterloo to the next station at

Vauxhall. Other examples of road tunnels under railway lines can be found in Bristol, Glasgow, Manchester, Newcastle and York.

As it might be argued that there are road tunnels under airport runways and railway lines, it could also be argued that road tunnels can be found under some of Britain's shopping malls. As some of these shopping centres were so large, it was considered easier to build them over existing roads and so create an artificial tunnel rather than fill in the road.

Most have pavements so pedestrians can walk through them, as well as a roadway for traffic. There are several examples of these types of road tunnel, such as the ones under shopping centres in Birmingham, Doncaster, Stirling and Kingston-upon-Thames. One of the longest is on the A1(M) where it passes under retail and urban development on the west side of Hatfield.



*Tunnel along Fairfax Street underneath the Galleries Shopping Centre in Bristol (formerly known as The Mall), built in 1991. Pedestrians are able to walk through it*

Below are some of the more unusual and striking road tunnels that I have discovered over the past few years. They can all be walked through as well as driven through.

### **On the Coast**

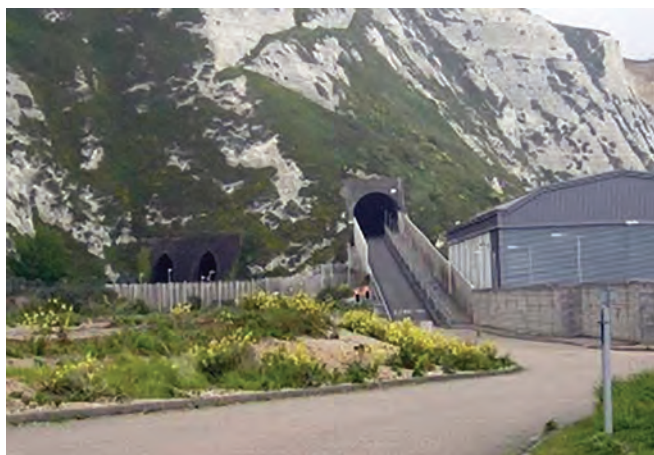
An unusual road tunnel can be found in the seaside resort of Blackpool in Lancashire. It was built as far back as 1932, two years earlier than the better known Mersey Tunnel, fifty miles to the south.



*Tunnel under the Pleasure Beach on Watson Road, Blackpool, looking west*

It was built to carry a road underneath the Pleasure Beach complex in the south of the town. Blackpool Pleasure Beach was first opened in 1896 and expanded rapidly over the next few decades into a thirty-acre site. The tunnel can be found on Watson Road, which connects the seafront road called the Promenade with Lytham Road. One tunnel that I have discovered thanks to Sub Brit is the one known as Samphire Hoe Road Tunnel, which is just off the A20, west of Dover. It was through looking in our *UK Site Directory* that I came to know of its existence. The tunnel was originally built in the 1970s during a previous attempt to build a tunnel under the English Channel. When the construction of the Channel Tunnel began in the 1990s this area below Shakespeare Cliffs was chosen as the ideal site to deposit the chalk spoil from the driving of the Channel Tunnel.

This section of reclaimed land just below the cliffs is now a popular nature reserve which was formally opened in 1997 as the Samphire Hoe Nature Reserve. The whole area may be called “Tunnel Corner” as not only is Samphire Hoe Road Tunnel here, but also an access tunnel to the Channel Tunnel, the Shakespeare Cliffs railway tunnels, the site of an earlier Channel tunnel shaft from the 1880s, and the ill-fated Dover Colliery.



*View looking north to the Samphire Hoe road tunnel. Note the steepness of the roadway and the railway tunnels on the left of the picture going directly underneath it*

If arriving by car, you may well have to wait at some traffic lights before you can proceed, as the tunnel is quite narrow. Once you drive down it you will be struck by its steepness. There is also a footpath on one side of the tunnel for walkers. Down at the bottom of the tunnel by the car park there is a memorial for the eleven men who lost their lives during the Channel Tunnel’s construction. The site also has a lighthouse, a “tea kiosk” and toilets. In the West Country the Mina Road Tunnel (above right) is a hidden gem in Bristol’s St Paul’s/Baptist Mills area, just north of the city centre. It carries the Mina Road north under the Severn Beach branch railway line. It is one of those tunnels where graffiti is allowed, though that doesn’t detract from its character, and also one of my favourite road tunnels.



Another of my favourite road tunnels is situated in Scotland near the town of Kirkintilloch, northeast of Glasgow, and could well be the shortest and smallest road tunnel in Great Britain.



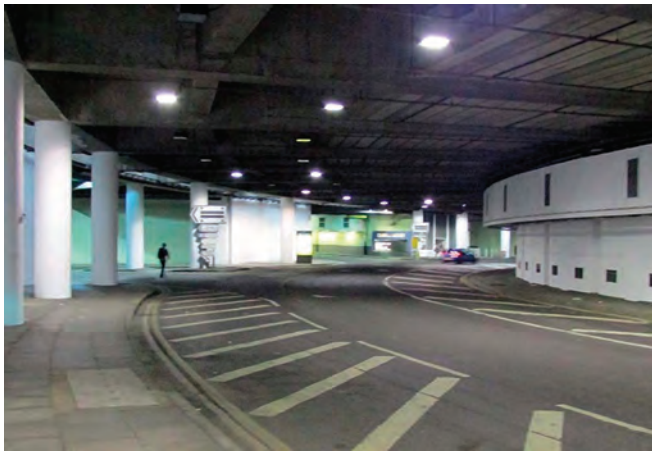
*This tunnel near Kirkintilloch, Scotland could well be Britain’s smallest road tunnel*

It is approximately 10 yards (9.1 m) in length and only 4 ft 9 ins (1.3 m) in height and goes under the Forth & Clyde Canal between Edinburgh and Glasgow. It is just about wide enough to take cars, but its low height stops vans and lorries passing through it. Like most minor tunnels in Britain, this tunnel doesn’t have a designated name and is not even on a numbered road.

The canal was opened to traffic in 1790, though I haven’t been able to find out if the tunnel was constructed at the same time. If it was, it would predate the Reigate Tunnel by over thirty years. For those who wish to visit this unusual tunnel, it can be found just off the B8023, about a mile east of Kirkintilloch in central Scotland.

The most unusual “road tunnel” of all can be found near Canary Wharf in east London’s Docklands. It is called Westferry Circus and is a double-deck roundabout which carries the A1206 north out of the Isle of Dogs, intersecting with other minor roads. The unusual thing about its construction is that the upper roundabout





*Is this underground roundabout a road tunnel?*

is at street level, whilst the lower level is completely underground.

It could be argued that this lower roundabout section is effectively a tunnel, even though it is completely round and not straight. It has four entrances/exits and carries a roadway underground. What do readers think?



*The road tunnel under the Victoria Circus Shopping Centre in Southend-on-Sea, Essex. This photograph shows the entrance which is still open to delivery traffic*

I can't resist the temptation of mentioning a road tunnel in my home town of Southend-on-Sea, where I have lived for over thirty years. The tunnel runs north from Southchurch Road and goes under the Victoria Circus Shopping Centre.

The only problem is that the tunnel is now a "dead end" and is only used by vans and lorries delivering goods to the shopping centre. Until a few years ago it was a fully functional road tunnel linking the Victoria Avenue roundabout with Southchurch Road. Then the local council decided to do away with the roundabout and replace it with traffic lights. As part of this "rationalisation" the northern end of the tunnel was closed off from the Victoria Avenue roundabout and thus the tunnel is no longer used as a through tunnel.

### Top Favourite Tunnel

Last but not least, I have left my favourite road tunnel of all to the end. This of course is the Queensway Tunnel

between Liverpool and Birkenhead, which goes under the River Mersey.

It was formally opened by King George V on 18 July 1934 in a lavish ceremony attended by hundreds of thousands of well-wishers. It took nine years to build at a cost of £8 million and employed 1,700 men. Of these, seventeen were killed during its construction and a memorial to them can be found on the George's Dock Building in Liverpool. (Also there is an original toll booth sited here.)



*Northern portal to the Queensway Tunnel in Liverpool. Note the four lanes of traffic with no central barrier. Also visible are statues of King George V and Queen Mary on either side of the tunnel entrance, as well as the original street lights*

When it was first opened it was known as the "eighth wonder of the world", as it was then the longest road tunnel in the world – a title it held for fourteen years, until the Vielha Tunnel was opened in Spain. It is still the longest road tunnel in Great Britain with a length of just over two miles (3.24 km).

What is unusual about it is that there is no barrier or central reservation between the two carriageways, so it can be quite hair-raising driving through the tunnel if you are not used to it. However, there is now a 30 mph speed limit and Heavy Goods Vehicles are banned from using it. Another unusual thing about it is that it does not have a designated road number. Plus it has its own dedicated police force.

For many years it was called the "Mersey Tunnel", but with the opening of a second tunnel under the river Mersey in 1971 between Liverpool and Wallasey, it came to be known as the "Birkenhead Tunnel".

The other tunnel (the "Kingsway Tunnel") came to be known as the "Wallasey Tunnel" and local street signs use this designation, as opposed to their more formal names. The tunnel also has two other exits – one on each side of the river. The Liverpool exit comes out by the Liver Building and the waterfront and is still in use, whilst the Birkenhead exit was closed in 1965, but is still used as service tunnel.

As far as I am aware, it is the only road tunnel in Great Britain where you can have a guided tour. I went on the tour a few years ago and was impressed with the detail that went into the building of the tunnel. It is actually a tube with the current roadway built on the top half of the tube. The lower part was meant to carry trams, but this



*View under the carriageway of the Queensway Tunnel between Liverpool and Birkenhead. Note the curved side of the tunnel. This passageway carries cables and can be used as an escape route if necessary*

plan was dropped during construction due to the cost. Today it is used as an emergency walkway and to carry pipes and cables. Here is the link to the guided tour for those who are interested: [www.merseytunnels.co.uk](http://www.merseytunnels.co.uk).

### A Look Ahead

Finally, what about the future for Britain's road tunnels? Are there any new ones in the pipeline? Well it seems that the planners have been busy with at least three that are a distinct possibility over the next ten years.

1) The Thames Gateway Tunnel which is scheduled to go under the Thames about five miles to the east of the Dartford Tunnel. It would join the M25 in Essex to the M2 in Kent via a tunnel crossing, probably between East

Tilbury in Essex and Chalk in Kent.

2) The Silvertown Tunnel. This tunnel would be sited to the east of the Greenwich Dome and cross the Thames from the Blackwall Tunnel approach road in the south to Silvertown on the north bank. It is planned to be open by 2021.

3) Stonehenge Tunnel. This is a long-running tunnel saga with different proposals in the years 1995, 2002, 2005 and 2013. This plan would reroute the A303 away from the World Heritage site of Stonehenge in Wiltshire with a 1.3 km tunnel.

There are some more way-out proposals for road tunnels in Great Britain however. These include a Trans-Pennine Tunnel between Manchester and Sheffield, designed to cut the journey time between the two cities to just thirty minutes.

Further south in Birmingham, a super tunnel under the city centre has been proposed, as has one under central London – a twenty-two mile long orbital tunnel called the “Inner Orbital London Tunnel” by the former mayor of London, Boris Johnson.

Another proposal is for two east-west tunnels to go under central London, one north and one south of the river Thames. Finally there have been plans mooted for a tunnel under the Irish Sea linking Ireland and Wales. Watch this space!

All photographs by Mark Chatterton, except where stated. Mark Chatterton can be contacted via the Hadleigh Books website at [www.hadleighbooks.co.uk](http://www.hadleighbooks.co.uk) or at [info@hadleighbooks.co.uk](mailto:info@hadleighbooks.co.uk).

## Hypogea 2019: Underground Bulgaria

There's nothing like planning ahead so here's early warning of a special underground event to be held in 2019.

The UIS (International Union of Speleology or Union Internationale de Spéléologie, in the original French) is the international body for caving and speleology. Founded in 1965, its members represent over 60 countries from all five continents. The vast majority of its work concerns the exploration of natural caves.

There is however a recognition that the exploration of man-made space also has its adherents and within the UIS is an ‘Artificial Cavities’ Commission. It's slightly contrived terminology but what matters is that it allows us to interact with enthusiasts from across the world whose prime interest is man-made underground structures and spaces. Most of the focus of the group is on historic rather than current excavations and the Commission brings together those who passionately believe in the value of underground space in telling mankind's story.

The UK representative on the Artificial Cavities Commission is our Chairman, Martin Dixon and the group includes representatives from many other, mostly European, countries. Many of the other representatives are well-known to Sub Brit and have helped with our own visits and spoken at our day meetings. The current President of the Commission is Mario Parise from Italy.



Every two years an international ‘Hypogea’ conference is arranged, at which presentations and site visits are made. Hypogea 2015 was held in Rome and in 2017 it was the turn of Turkey to host the event in Cappadocia. For 2019, the plan is to hold the event in and around Varna in Bulgaria from 20-26 May. Sites to be visited here include underground monasteries, churches and catacombs as well as day to day living spaces. There are also likely to be stone quarries and other mines and tunnels to visit.

It's too early for booking arrangements to be known but why not make an early entry in your 2019 calendar and consider joining fellow enthusiasts for an exciting glimpse into underground Bulgaria?



# Chilmark RGHQ 7.1 – Wiltshire

Steve Fox and Nick Catford



*The canteen and kitchen on the upper floor. Like many of the rooms on the upper floor the canteen was used to store electrical junk after sale in 1997. The servery is seen in this view. Note the chessboard tile pattern on the floor*

The Chilmark Regional Government Headquarters served the eastern zone of Number 7 South Western Home Defence Region, which covered the counties of Gloucestershire, Avon, Wiltshire, Somerset and Dorset. It was designated as RGHQ 7.1 with the old Rotor bunker at Hope Cove in Devon being 7.2.

The basic concept for the bunker dated from 1975 but design work was not started until 1979 and was done by the government's Property Services Agency. Even then, it was not until 1982 that detailed designs were drawn up. The bunker became operational in 1985 when it replaced the former Anti Aircraft Operations Room building at Ullenwood, which in turn was taken over by Gloucestershire County Council as its emergency centre. The Chilmark site was sold in 1997 by a sealed bid auction.

## **Underground bomb store**

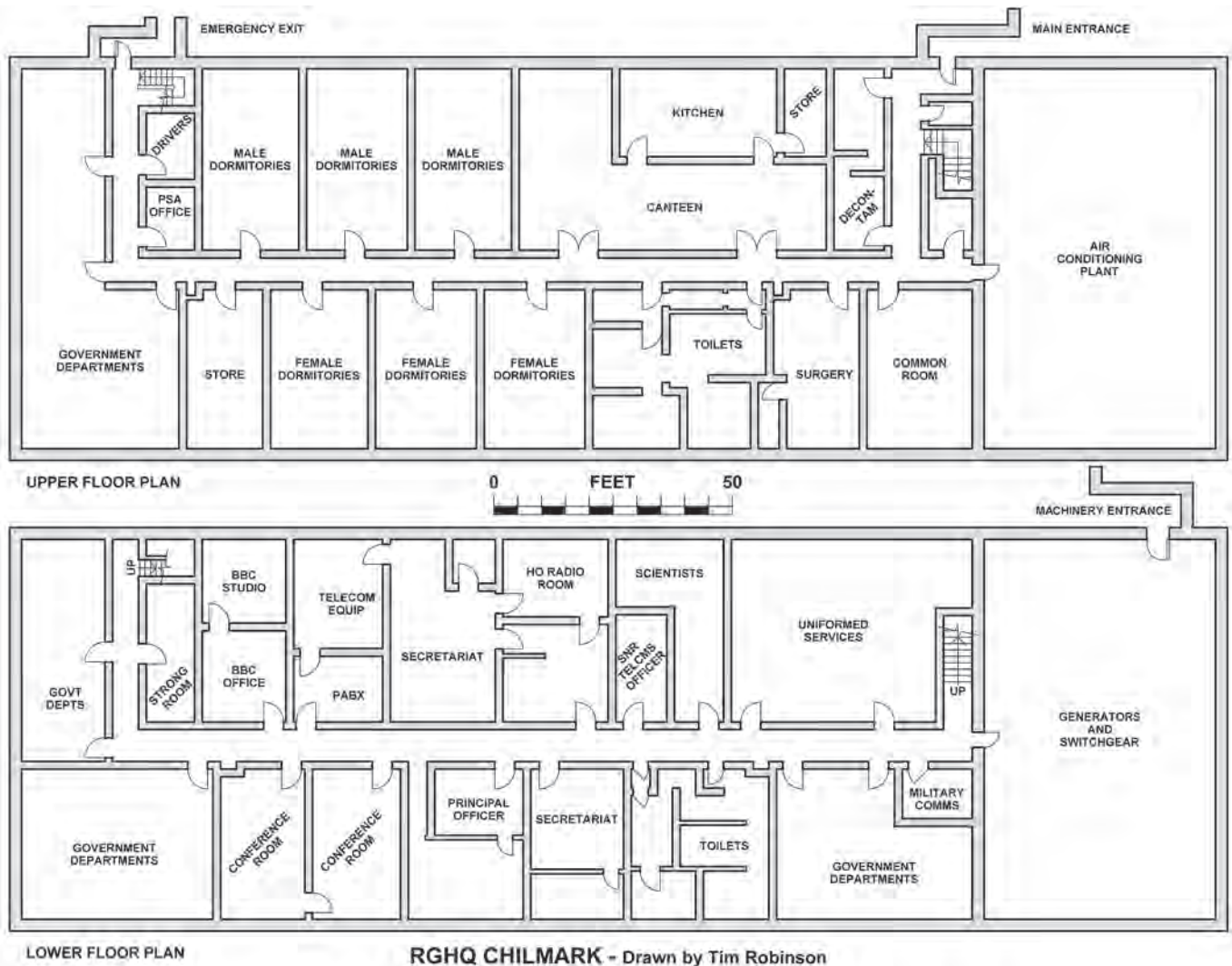
The bunker is two miles from the picturesque Wiltshire village of Chilmark about ten miles west of Salisbury and occupies a small part of what was RAF Chilmark. This was a major underground bomb store dating back to before WWII. The new bunker was however built on the surface opposite the railhead for the bomb dump and was referred to publicly as 'RAF Chilmark Site F' or more usually as 'Crown Building Chilmark'.

The bunker site covers 3.5 acres surrounded by a basic wire fence with a single gate for vehicle access. As usual, there are no signs to indicate the purpose or ownership of the site. The bunker is in the southern part of the site, most of which is planted with grass and trees. There is a large area of 'grasscrete' hard standing for parking.



*Seen from the air the bunker is not obvious; only the ventilation towers and aerial mast are easily visible*

RGHQs, like their predecessors, were not expected to be proof against the blast of an H-bomb and the entrances and air-vents were particularly vulnerable. A frequently quoted figure is that they were expected to withstand



RGHQ CHILMARK - Drawn by Tim Robinson

an overpressure of 1.5 pounds per square inch, which, according to Home Office figures, would be experienced up to five miles from a 500-kiloton ground burst.

The RGHQ building was however designed to give a good level of protection against fall-out. A protection factor or PF of 400 is sometimes quoted. This figure has been in use since at least 1964 and means that the level of radiation inside the building would be 400 times lower than outside. This is roughly comparable with a well-prepared cellar under a strongly built house with no openings.

By contrast, a normal house would have a PF of only about 20 even with its doors and windows sealed. Ignoring the problems caused by entrances and ventilation openings, a PF of 400 could be achieved with two feet of concrete covered by an equal thickness of soil.

The RGHQ was nominally provisioned for 30 days. It was not expected that the staff would stay inside for all this time, but only when fall-out levels made it unsafe to go outside. In time, its functions would be transferred to a convenient surface building that would allow more staff to be recruited, but given its pivotal role as a communications centre the RGHQ would likely be used for many months at least.

The RGHQ was built on the surface, and then covered by earth and grassed over. The concrete roof was 0.5 metres thick and

the walls 0.3 metres thick. The air intakes and outlets were mounted on the roof where not only were they a vulnerable point for blast damage but the intakes would also draw in and concentrate fall-out. All RGHQs had a main and an emergency entrance. At Chilmark, they, perhaps surprisingly, both opened from the northern side of the bunker.



*The air intakes and outlets on the roof of the bunker*

Both entrances gave access to the upper level of the bunker. The main entrance was protected by a right-angled covered entrance 'porch' giving access to another blast door. Alongside this was a removable panel giving equipment access to the upper plant room. Alongside this

was a machinery entrance with a ramp down to another blast door in the lower plant room. The emergency entrance was via a simple ramp to a blast door.

### Minimal security

Whilst the bunker was fitted with an extensive fire and intruder alarm system, there were no external security facilities. The RGHQs would possibly have been designated as Key Points meriting a small police or military guard but otherwise the staff would have had to look to their own protection. If disaffected survivors attacked the bunker the staff could only close the doors and call for help.

Internally the operational part of the bunker was some 160 feet long by 70 feet wide with a central corridor on the long axis of both levels and a staircase next to each entrance. At the eastern end, and integral with the bunker, were the plant rooms that added another 40 feet to its length. The internal walls were mostly of simple white-painted breezeblocks and all the operational rooms had large pin-boards on the walls.



*The central corridor on the upper level looking towards the main entrance. The emergency exit is to the left. The door at the end of the corridor is the upper level plant room*

Most rooms had ducting for the air circulation system hanging from the ceiling. There were numerous telephone extension points, particularly in the open plan office areas allocated to 'government departments' or 'uniformed services' ie police, fire service and the military. There were relatively few power points indicating the general lack of office or domestic equipment.

There were no computers, word processors or photocopiers in RGHQs and no maps or stationery were stored there. In theory, at least, these would have been supplied on manning up by the Stationery Office under dormant contract arrangements or the staffs would have brought their own. In the days of the RSGs some government departments maintained packs of maps, reference books, etc ready for use.

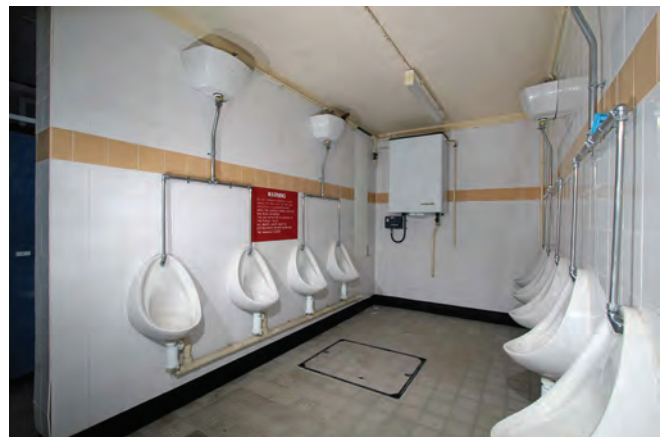
The first floor was largely given over to domestic accommodation. The main entrance area contained the decontamination unit. This consisted of a basic shower, without a curtain, and a bin to hold contaminated clothes. Anyone who had been outside and exposed to fall-out

would shower off the contaminated dust and then remove their clothing to be stored in the bin. No stocks of spare clothing were held.

### Metal bunk beds

The first floor had six dormitories, nominally three male and three female, although the gender distribution of the staff would not be an influencing factor. Dormitories were equipped with two-tier metal bunks each of which was provided with a blanket pack and a small personal locker. Bunks and other equipment were supplied for a nominal staff of 150. Only the Regional Commissioner and Principal Officer had the privacy of beds in their own offices.

Exercise Bright Fire, held in 1988, showed that this type of domestic accommodation could cause problems, particularly if people were coming and going at all hours and the only lights would be the main neon strip-lights which were common throughout the bunker. Sleeping may well have been difficult. The communications team would have worked on a two-shift basis to give continual manning but the rest of the RGHQ's staff would have worked as necessary. Although there was a Common Room with a few armchairs there were no recreational facilities. There were male and female toilets on both levels with showers in the upper one.



*Male urinals on the upper floor*

A small sick bay was provided with a large first-aid kit. The Community Physician from the DHSS would have provided medical assistance. Male and female toilets were provided with sinks and showers for washing and instantaneous electric water heaters were fitted. Staff would be expected to bring clothing and personal kit for 30 days but in most RGHQs there were no facilities to wash or dry clothes.

The canteen area occupied a large part of the first floor. The dining areas were equipped with basic tables and chairs. Crockery and cutlery were kept on site. The kitchen was well equipped with stainless-steel ovens, sinks, two large fridge-freezers, a meat slicing machine and a bain marie servery.

### Basic catering only

Food stocks were not permanently kept at the RGHQs. In the manning stage, some fresh food might be sought locally, possibly under the direction of the Civil Service



*The high standard of fixtures and fittings in the well equipped kitchen is evident here. Everything is stainless steel including refrigerators and freezers which are seen in the background. The servery is to the right*

Catering Organisation but the main food source would be 'compo' rations supplied by the army. A basic 30-day supply would be held together with a 15-day reserve. Once the basic 30-day supply had been used, further supplies would have been sought via MAFF or the local authorities.

The draft Standard Operating Procedures copied sections from RSG instructions which suggested that toilet requisites, sweets, cigarettes and possibly even canned beer might be available but given the reality of the times, it seems unlikely that such items would have been provided. There would be a restricted amount of cleaning materials available, but probably only what the peacetime Custodian kept.



*Part of the suite of offices on the lower floor provided for the Regional Commissioner's secretariat*

The Regional Commissioner and Principal Officer had their own offices. Nearby were offices for the Secretariat, which would be the administrative hub of the RGHQ and the focal centre for handling all the major problems confronting the Regional Commissioner. Its basic function was to co-ordinate the assessment and consideration of problems with a view to ensuring that all the major decisions emanating from the RGHQ had been considered by all those concerned.

This would involve, amongst other things, co-ordinating all activities within the RGHQ, issuing instructions on behalf of the Regional Commissioner either within the RGHQ or to local authority Controllers and other outside bodies, drafting scripts for regional broadcasts and preparing situation reports for neighbouring RGHQs and central government.

The Secretariat would also maintain the Information Room that would plot the strategic position of the region mainly on maps. As most problems facing the RGHQ would involve more than one department or service the usual method of operation would be by committee. These would either be standing committees meeting twice a day or ad hoc committees established for specific purposes. A Conference Room was available for meetings.

Although not provided at Chilmark, other RGHQs had a room for Common Services, which would really be a store for stationery items, and a Typists Room. Other rooms, if available, were designated as stores. Chilmark, like most RGHQs, had a Strong Room. This was a relatively small room with a security door. Its intended use is not obvious given that none of the RGHQ's work would be secret and no high-value or secret documents would be kept. In practice, the Strong Room was often used to keep general equipment safe from the many maintenance workers who passed through the bunker.

### **Communications were vital**

The majority of the space on the lower floor was given over to communications. There was a BBC office together with a complete sound studio from which the Regional Commissioner could broadcast via local radio transmitter sites. Next to the BBC suite was the communications centre or Comcen. The main room here was the Counter Room (sometimes called the Comcen Registry) where outgoing messages were checked and prepared for transmission and incoming messages directed to the correct recipient.

There were three main message systems. The RGHQ was connected to the normal public switched telephone system but this would quickly fail in wartime and be



*The BBC Office. The studio controller would have sat facing the person speaking in the studio (on the far side of the window)*



*The BBC studio is lined with acoustic tiles to deaden the sound*

replaced by the skeleton Emergency Manual Switching System or EMSS. This would allow connection to a couple of trunk circuits which could connect the headquarters to various agencies such as ports, airfields and public utility headquarters which were not on the Emergency Communications Network or ECN.

The ECN provided the main dedicated links to neighbouring RGHQs, the county council main and standby emergency centres and the county police headquarters within the sub-region and the nearest Royal Observer Corps Group Control. These 'line' systems were backed up by radio and there was a Home Office Radio Room and a Military Radio Room.

### Electricity back-up

All the RGHQs were connected to the normal electricity supply but this was expected to be lost in war and they were provided with two, occasionally one, diesel generators. At Chilmark, in a sound-proofed area in the lower plant room were two 147kW diesel generators which would supply electrical power if the mains supply had failed. The generators were supplied with diesel via a small daily service tank and a 48,000 litre main tank.



*One of the two diesel generators*

The lower plant room also contained the generator control panels, the main electrical switchboard and the heating and ventilation system control panel. One generator would automatically start 30 seconds after the external power supply failed. The bunker's power needs were divided between essential and non-essential loads. Normally one generator would supply each, but if



*The generator control panels and the main electrical switchboard*

one generator failed the other could supply the essential load to provide basic communications, lighting and a minimum of air conditioning and cooking.

In most RGHQs, the generators were sited outside or at least apart from the main part of the building probably because of the noise they produced and their need for an air supply. If the air did not first go through the filters, it would result in the generators building up potentially high levels of radiation.



*The generator room on the lower floor; the cabinets at the rear appear to be wrecked. The machinery entrance blast door is seen on the right*



*The machinery entrance blast door*

## Temperature control

The upper plant room contained the complex air supply system. Under fall-out conditions, air would be drawn into the bunker through large vents in the air intake gallery on the bunker roof. This would then be passed through a series of filters, including High Efficiency Particulate Air filters to remove the contaminated dust. It would then be heated or cooled to maintain a working temperature of 20 degrees Centigrade.

During peacetime operations, the filters could be bypassed. The system could also operate in a completely shutdown mode recirculating the internal air. Air circulated around the bunker in metal ductwork at ceiling height. When unoccupied the ventilation system maintained the internal temperature at 14 degrees C.



*The upper level plant room*



It was important to keep the air conditioning running even when the bunker was unoccupied to stop the humidity rising which would damage the electrical and communications equipment and lead to the growth of mould. The air would also have to be chilled and dried because when fully manned the staff would give off a lot of heat and moisture.

The Chilmark bunker shows that an RGHQ could provide essential office accommodation for the Regional Commissioner and his staff together with the necessary communications systems. But it also shows that the bunker, assuming it was properly provisioned, could be self-sufficient providing not only reasonably good working conditions but also all the necessary domestic

facilities for the staff for around 30 days should the outside conditions require it.

## Under new ownership

After decommissioning, the bunker remained empty for a few years before being sold by auction in 1997 to David Graham, a local Bradford-on-Avon businessman. He appears to have bought the bunker on a whim for £140,000, with no specific purpose in mind.



*Signs on the entrance gate*

David Graham ran a secondhand electronics disposal/recycling business called 'The Green Shed' and within a few years the bunker was crammed full of (mainly ex-MoD) surplus electronic equipment. David attended one of the Sub Brit days at Hack Green c.2001 and at that time he said it would be possible to arrange a visit to the bunker for members of Subterranea Britannica. A number of attempts were made to arrange a visit, but David proved very elusive, living in France much of the time and never answering his phone. Eventually we gave up. In 2011 the bunker was once again put on the market with the proposed sale being handled by Andrew Black from Estate Agents & Property Consultants Carter Jonas. Mr Black became something of an expert on the sale of Cold War bunkers having handled the sale of Cultybraggan RGHQ and having been involved in the sale of Skendleby RGHQ.

Andrew Black joined Sub Brit in March 2011 and was able to arrange a visit to Cultybraggan for Sub Brit members. He was less successful with arranging a visit to Chilmark however. A number of banks were supposedly interested in buying the bunker for use as a data centre.

Your scribe was contacted by David Graham in December 2012. He told me that he was now living in the bunker. He said it was still on the market with one bank in particular close to signing a contract. He said that he was now happy for a small party from Sub Brit to visit and take photographs and this was arranged for 3 January 2013.

## Visit to Chilmark RGHQ

Six members of Subterranea Britannica arrived at the bunker on a cold January day with snow on the ground. The entrance to the bunker is along a short drive opposite the main rail-transit sheds for RAF Chilmark. The bunker





is not obvious from the road, only the now-disused radio mast to the rear indicates to the passer-by that there is something there. Faded signs on the gate indicate that the site belongs to the Ministry of Defence but would only suggest it is another part of RAF Chilmark.



*These buildings are opposite the entrance drive to the bunker. The buildings on the left, and in the right background, are the main rail-transit sheds for RAF Chilmark. The building in the right foreground is a police/security lodge. Anyone driving along the road would have assumed the bunker was just another part of RAF Chilmark*

Initially there was no sign of life but after we pressed the bell on the gatepost David Graham appeared from inside the bunker and opened the gate, allowing us to proceed up the short drive to the entrance. Although it was winter the bunker was still quite heavily overgrown but some of the grasscrete around the entrance had been cleared to provide sufficient parking for a few cars.

Initially there was some confusion about photography but this was quickly ironed out and we were given the freedom of the bunker. There are two adjacent inclined entrances cut into the earth bank on the northwest side of the bunker. That on the left goes down to the lower plant rooms and that on the right goes up to the main entrance. Once we were through a metal grille there was a dog-leg corridor leading to the main blast door.



*Looking out of the bunker from the dog-leg corridor*  
After the airlock there are two routes into the bunker,

with personnel going through a decontamination suite or directly into the bunker after passing a small guard room.

### **Jumble sale**

Once through the entrance airlock everybody scattered in different directions to explore David Graham's 'Aladdin's Cave' with every room on the upper floor being filled with electronic and electrical bric-a-brac and, to be perfectly honest, mainly junk. David Graham retired to his living quarters which he had established in the old sick bay close to the entrance. He told us that everything was for sale and that no reasonable offer would be refused.

Having seen pictures of the bunker taken during the public open day prior to sale in 1997, we knew that all the fixtures and fittings throughout the bunker had been removed, leaving mainly empty rooms. Only the plant rooms and the kitchen/canteen remained largely intact and in original condition.

From the entrance there is a spine corridor; to the left is the air-conditioning plant room and steps down to the lower floor and to the right domestic and welfare rooms. Your author first went to the canteen which together with the kitchen and adjacent store is probably the largest room in the bunker.

It was difficult to pick a clear route across the canteen floor but the kitchen itself was largely clear of junk with all the stainless-steel fittings and appliances still in place and in good condition. The floor of the canteen is tiled with a black and white chessboard pattern with the stainless-steel servery facing onto the canteen in the centre. As with other RGHQs the canteen was fitted out to a high standard and most of the stainless-steel fittings and appliances are still in place including refrigerators and deep freezers.



*The kitchen with the servery on the left*

Much of the upper floor comprised dormitories which were all completely stripped and now filled with electrical junk. The toilets on both floors were free of any clutter with their white-tiled walls, handbasins, urinals, mirrors and wcs all remaining in good condition but of course no longer usable.

At the end of the upper-floor spine corridor there is a large L-shaped room allocated to 'government departments'; this is the only office accommodation on the upper



*The lower floor ladies washroom and WC cubicles*

floor. The spine corridor turns through 90 degrees to the emergency exit blast door and stairs down to the lower floor.



*The L-shaped government departments room on the upper floor. This is one of the largest rooms in the bunker*



*The emergency exit blast door and, to the right, stairs down to the lower level*

There was less clutter on the lower floor which housed office accommodation and operational rooms. As with the upper floor most rooms were stripped of all original fixtures and fittings. A suite of offices was provided for the Regional Commissioner's secretariat; this has a window between two of the rooms. Some furniture remains here but this is more likely to have been brought in after the bunker was decommissioned.

## Broadcasting facilities

The adjacent BT rooms still have plenty of evidence of their former use, with a large quantity of wiring still in place as is a wall-mounted distribution cabinet. A number of telephones are lying on the floor but those and a rack-mounted unit sitting on a table may have no connection with the exchange. Next door are the BBC office and BBC studio. As with all similar BBC suites there is a window between the two rooms with a light to indicate when the studio is 'on air'. The walls of the studio are lined with acoustic tiles but both rooms are completely empty.



*The BT equipment room. The wall cabinet on the right was connected to the Mitel SX2000S ECN cabinet*



*The PMBX room with a small MDF. The Compaq unit on the table is an old PC/server*

Plant rooms are allocated at the east end of both floors. The lower-floor plant room is entered from the end of the spine corridor and opens into the main electricity distribution room. From here power is distributed throughout the bunker for lighting, heating and ventilation purposes. Switchgear is provided to control the air-conditioning plant on the floor above.

Power for the bunker is normally taken from the national grid but in the event of failure the main generator would switch in automatically. The internal power plant could also be switched in manually from this point or remotely by pressing a prominent button in the guardroom just inside the main entrance.

Fuel tanks and two generators are located in a room to one side of the distribution room, with water tanks on



*The main entrance blast door is up the ramp on the right.  
The ramp down on the left leads to another blast door.  
This is the machinery entrance at the rear of the generator  
room on the lower floor*

the other side. Each of the two generators is capable of sustaining the normal load of the bunker under emergency working conditions. The second generator is a standby in case of failure of the first one. On the far side of the generator room is a large blast door behind which is a dog-leg passage and a ramp up to the surface alongside the entrance ramp.

Once back on the surface we were able to walk up steps onto the earth mound that covers the bunker to view the ventilation towers above the plant rooms.



*At most former RGHQs the new owner gets a modest  
income by letting out space on the radio mast.  
At Chilmark the mast remains unused*

A number of Sub Brit members purchased items of electronic equipment from David Graham and we were even allowed to remove some small appliances from

the kitchen and part of the servery for reuse at another RGHQ where the kitchen isn't as well preserved as that at Chilmark.

Over the following few weeks it was possible to arrange a further two visits for a small number of Sub Brit members before the bunker took on a more sinister role.

### **Chilmark becomes a cannabis factory**

Later in 2013 the bunker was leased to Martin Fillery who had previously written a screenplay about cannabis production. Initially Fillery lived in the bunker and used it for his business selling movie and TV memorabilia, much of which was stored in the bunker. This included a large number of Daleks.

Wiltshire police were tipped off about a cannabis factory by dog walkers and a delivery driver who noticed a strange smell in the remote area of countryside near the sub-surface bunker. They mounted a CCTV surveillance operation over three periods which led to a raid on the bunker in the middle of the night on 22 February 2017.



*Police enter the bunker through the main entrance.  
Photo by David Levene*

Police knew that the bunker was almost completely impenetrable, so officers waited outside until three people arrived by van in the middle of the night and went into the bunker. As they came out again the police immediately detained them, using their keys to gain entry. Once inside, officers found three people, apparently operating as gardeners, along with several thousand cannabis plants at various stages of growth.



*Cannabis plants were found growing in many of  
the bunker's rooms. Photo from Wiltshire Police*

Two young Vietnamese men and a Vietnamese man in his 30s were arrested on suspicion of cannabis production and taken to Melksham police station. The three males detained outside the bunker, Martin Fillery, 45; Ross Winter, 30; and Plamen Nguyen, 27, all from Somerset, were arrested on suspicion of cannabis production and human trafficking offences. A fourth Vietnamese man was found the following day, wandering the lanes near the village of Tisbury. Police believe he had managed to escape by cutting his way through a metal ventilation tunnel in the roof.

### Slave workers

Following investigation by the police it became clear that the Vietnamese men working there were enslaved and extremely scared. They had been trafficked from Vietnam, and placed there and told to work. Fillery and Winter arrived during the night most weeks to bring in supplies for the workers and take away harvested crops. Their visits lasted from several minutes to seven hours, during which time both the bunker door and the outer gates were kept locked.



*Living conditions for the 'farmers' were poor. They lived in the former sick bay which had also been used as a bedsit by the bunker's owner David Graham. Photo David Levene*

It was not clear how long the Vietnamese men had been held there, working in the tropical temperatures necessary for the plants to grow with no natural daylight, and with limited fresh air. Food and water supplies to last several weeks were stored in the bunker's kitchen. The men slept on mattresses on the floor of the bunker's sickbay, the room that had previously been David Graham's living room. They diverted electricity which created a significant fire risk, which was particularly dangerous given that the men were locked in.

On 24 February 2017 Fillery, Winter and Nguyen were charged with conspiracy to produce a quantity of cannabis – a class B drug. They were also charged with abstracting electricity without authority and conspiring to hold another person in slavery/servitude.

The Vietnamese men, who spoke no English, were released without charge. They were told by police that they were being considered as victims and could be assigned to the national referral mechanism, the framework for identifying victims of human trafficking,



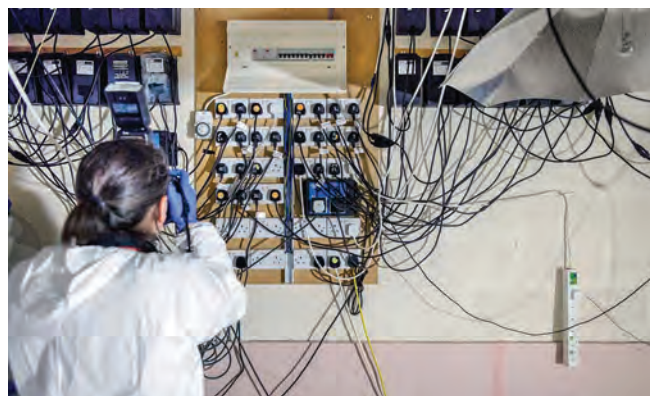
*Cannabis plants being cleared; they were later incinerated. Photo David Levene*

under which they were eligible for 45 days of secure, sheltered accommodation and legal advice. However, all four men declined the offer and refused to say anything. It was possible that traffickers knew where they lived and had made threats against their family members. Three were subsequently deported for immigration offences and the fourth has claimed asylum.

### Guilty as charged

On 9 June, Fillery, Winter and Plamen Nguyen pleaded guilty at Salisbury Crown Court. In addition to admitting charges of drugs conspiracy and abstracting electricity, they admitted a charge of possession of criminal property in relation to money laundering.

The court heard that police found 4,400 plants in various stages of growth. They also found 6,500 dead plants with a total value of £1.25m and about 20kg of harvested and dried cannabis with a value of about £99,000. In total 643kg of the weed had to be incinerated.



*Inspecting electrical work in the bunker. Photo David Levene*

Detectives believe the site had been operating since 2013, gradually increasing in size as more rooms were converted for cultivation. The 'farm' was understood to be capable of producing £2m of cannabis every year. Police estimate that £650,000 of electricity had been siphoned off illegally from a nearby electricity pylon to power hundreds of lights and fans. Professional electricians had been brought in to wire up an illegal connection to the mains supply and a borehole had been drilled to pipe in fresh water.

In addition to the growing rooms, there were drying rooms and nurseries. The lighting equipment alone seized from the site cost in the region of £140,000 and the setup was capable of producing a crop every six weeks. It took police approximately ten days to completely search and clear the site. Fillery, of Ashcott, Bridgwater, Somerset, was also found in possession of criminal property at his home; this included movie memorabilia worth £1m.

The slavery charges against the three accused were dropped on the advice of the CPS as it is difficult to prosecute people for slavery without the cooperation of the victims. Police could prove that they were locked in but that's not enough for the case to be proved beyond all reasonable doubt.

Efforts to prosecute for slavery were complicated by the fact that one of the Vietnamese men was apparently able to flee through the ventilation hatch. Police could see a metal bar had been cut but were unable to prove if the bar had been cut after or before the raid. The man was found carrying more than £1,000, raising questions about whether he and the other men had been paid, or whether he knew where money was kept on the site.

Fillery had a "leading role", according to the prosecutor, while Winter provided transport and Nguyen acted as a liaison and presumably interpreter. Sentencing the men, Judge Keith Cutler said: "Each of you has played a part in what amounts to one of the most serious crimes that this area has seen for a long while."

He added that their production of cannabis was on "an industrial scale". He sentenced Fillery to eight years in jail and Winter and Nguyen were each sentenced to five years. As the sentences were announced, anti-trafficking organisations said they were concerned that slavery charges against the three had been dropped despite investigators' certainty that four Vietnamese men had been discovered locked inside the site with no access to keys.



*The upper level corridor of the cannabis farm.  
Photo from Wiltshire Police*

### Former RGHQ again for sale

In October 2013 a huge collection of movie and TV memorabilia collected over several decades by Martin Fillery was sold by auction in Belfast. This included a *Star Wars* Stormtrooper and Ewok statue, a *Doctor Who* Cyberman figure, a *Willy Wonka* statue depicting Gene Wilder in his famous role, as well as an ET model from Steven Spielberg's classic 1980s film.

The bunker is still owned by David Graham, who is currently living in France. He was questioned by police but denied all knowledge of the cannabis factory. He is now keen to dispose of the bunker at the earliest opportunity. If anyone would like to buy it please get in touch and we will pass your details on.

Some text taken from *Struggle for Survival - Governing Britain after the Bomb* by Steve Fox

Photos by Nick Catford except photos of cannabis farm from Wiltshire Police

## Membership Renewals

Membership of Subterranea Britannica runs out on 31st December each year;  
thank you for your support during 2017.

We'd be very pleased to see as many members as possible rejoining the society for 2018.

You may already have done this, but if not then  
follow the instructions below to renew your subscription.

**Remember** that this will be the last edition of *Subterranea* that you will receive, unless you rejoin.

We will be sending out renewal reminders, but it would really help us  
if you could renew promptly; sending chasers costs us effort and money.

If you have previously ticked the box to allow us to claim Gift Aid on your subscription then many  
thanks. But do please remember that you have to notify us if your tax situation changes.

To renew, go into 'mySUBBRIT' and click on 'Renew membership'; or send your details  
(including any changes) and a cheque for £21 (UK; £31 for Overseas members)  
to Tony Radstone, Buckby House, Wharf Lane, Bourne End, SL8 5RS



# Thames Tunnels Tour, October 2017

Martin Dixon



*Waterloo and City line access point and sidings at Waterloo station*

## Five a Day

At a couple of recent Sub Brit Day Meetings at the Royal School of Mines, members have suggested that we arrange a visit on the following Sunday particularly so that ‘out of town’ members can make a weekend of it. Always keen to take up a challenge, I created an itinerary that crossed beneath the Thames five times, each transit being in a different sort of tunnel.

We would traverse the Thames in tunnels used for tube, Docklands Light Railway, London Overground, pedestrian and road traffic. We also planned to view some features related to other crossings which we might study in more depth (pun intended) on a subsequent visit.

## Underview

The River Thames was first tunnelled beneath in an epic project by the Brunels – father and son – between 1825 and 1843. This project would be our final destination of the day. The newest tunnel we would visit was opened in 1999. You can say what you like about tunnel construction but it’s always boring!



*LU track plan around Waterloo*

Linda and I undertook a recce visit on the previous Sunday (generally a good day for lower passenger numbers but susceptible to line closures) and issued the final itinerary, praying for good weather. Sunday 29 October dawned and our prayers were answered with a crisp, dry and sunny morning. Forty Sub Brit members assembled and we were ready for the off.

Our meeting point was above ground but underground-related: the shaft from where rolling stock for the Waterloo and City line can be brought to the surface in Spur Road, adjacent to Waterloo Station.



## Waterloo and City line

When mainline trains reached Waterloo Station in 1848, many of its passengers were commuters destined for the City, the financial district. The final stage of their journey lay across the Thames and became a bottleneck and an inconvenience. As a result the Waterloo and City Railway was eventually authorised in 1893. Construction began in 1894 with the underwater section being constructed using Greathead Shields driven from shafts protected by coffer dams in the Thames itself.



*Waterloo and City line carriage (1898)*

The line was formally opened on 11 July 1898 by the Duke of Cambridge and opened to the public on 8 August of the same year. The service was operated by the London and South Western Railway from the outset and was formally taken over by that company in 1907.

In 1923 the LSWR became part of the Southern Railway and as a consequence the line was not taken over by the London Transport Passenger Board in 1933 (although it was depicted on most of the board's tube maps). The Waterloo and City line was finally absorbed into London Underground as late as 1994, although still physically separate.

The total length of the line is one mile 1,012 yards (2.5km); at its deepest it lies 23 feet below the river bed. The line had (and still has) just two stations – at Waterloo and Bank (originally 'City'). The whole line is completely underground and has no connection with other lines.

In order to insert and remove rolling stock a hydraulic lift was installed to the west of Waterloo Station. This was constructed by WG Armstrong and remained in operation until 1990 when the site was overbuilt by the new International (Eurostar) Terminal. To replace it a shaft was constructed to the east of the mainline station which requires the use of a road-mounted crane for major lifts. As we waited for the group to assemble, members could see part of the stabling sidings through the shaft, which is covered by a metal grid and secured by a host of padlocks. Sadly there was no crane activity that day but it formed the ideal meeting point. The line is closed on Sundays and so we were unable to travel through this tunnel – still known colloquially as 'the Drain', believed to be as a result of the amount of water that needs pumping from the tunnel's sump.



*The WG Armstrong hydraulic lift in September 1974.  
Photo from KDH Archive*



*A Waterloo & City line 92TS car is lifted out of the stabling sidings for refurbishment, whilst the line is closed for a six month revamp. Photo Stephen King*

## Northern line (Charing Cross branch) – Crossing #1

So our first crossing was to be on what we now know as the Charing Cross branch of the Northern line. It was built as the Charing Cross, Euston and Hampstead Railway which, commonly known as the Hampstead Tube, opened in 1907.



*1914 cutaway of the underground lines at Embankment. To the left are the two Bakerloo line platforms and on the right the single Charing Cross, Euston and Hampstead (later Northern line) platform*

Our party took the subterranean passage to the Northern line passing close to the terminus of the Waterloo and City line, whose platforms were ingeniously installed between the original support arches for the mainline station. All attending were prepared with travelcards, Oyster or Freedom Passes so off we sped.

We travelled just one stop to Embankment and disembarked onto the tightly curved northbound Platform 3. The southern terminus of the CCE&HR was originally at Charing Cross (without connection to the Baker Street and Waterloo platforms which had opened earlier as Trafalgar Square).

The line was extended one station to the south in 1914 to provide an interchange with both the BS&WR (today's Bakerloo line) and the District Railway (now District and Circle lines). This new terminus had a long turning loop and a single platform formed in part of the loop, hence its tight curvature.

So tight is the curve that it is one of the few platforms that has a permanent TfL employee to monitor the passenger flow and give the driver clearance to pull away. We took note of the (disused) flood prevention doors that protected the platform entrances and listened attentively to the automated safety announcement.



*Brief wait for the next train*

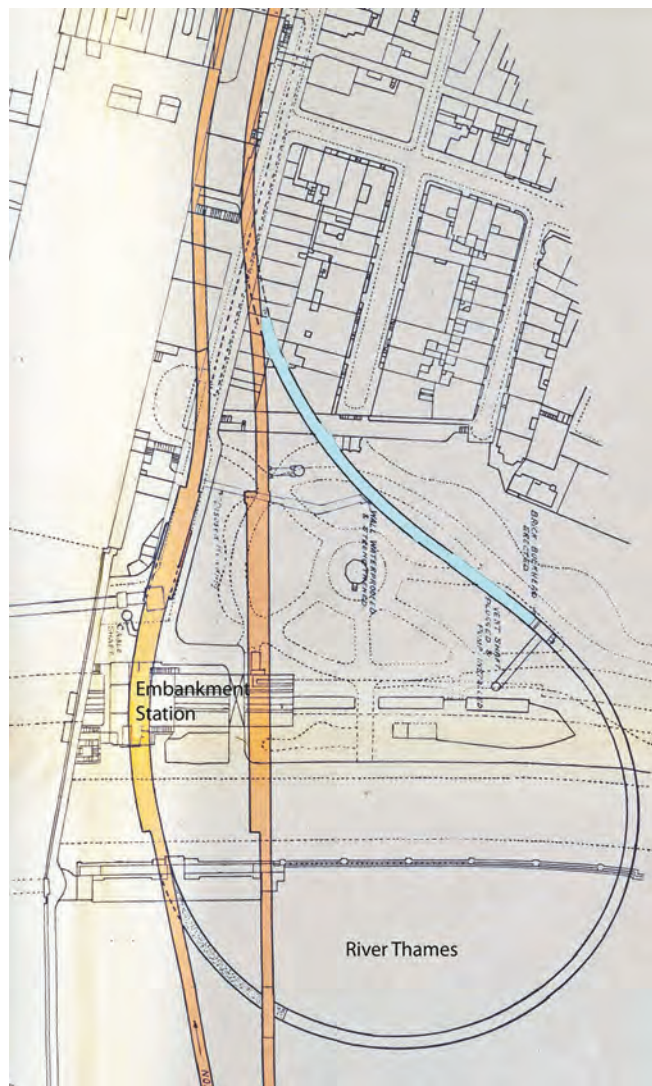
### Mind the Gap

Several different voices have been used over the years for *Mind the Gap* announcements and the Northern line used to feature actor Oswald Laurence. After his death his widow used to enjoy hearing his voice on the platforms and was upset when it when it was replaced in 2012. After she contacted TfL bosses, the recording of Oswald was reinstated at just one station – the northbound Northern line at Embankment!

Opening in 1926, a further extension led properly under the Thames to stations at Waterloo and Kennington, where there was an interchange with the (now) City branch of the Northern line. The turning loop was abandoned and sealed with bulkhead doors. Just as well, as it turned out, as on 9 September 1940 a German bomb fractured the abandoned loop and flooded a large section of it.

The 1926 extension created a new southbound platform (platform 4) which is perfectly straight, in contrast to the tight curve of the northbound. We had of course to see for ourselves and so we moved to view platform 4. Having completed our subterranean examination, we exited the station to see where the lines lay in relation to surface features.

John Poole (who used to be a station manager at Charing Cross) gave us a vivid description of what was happening beneath our feet in Embankment Gardens – even to the extent of pointing out the tree beneath which the disused turning loop is blocked.



*Track plan of original Charing Cross loop, showing surface features*

We could also see York Gate, built in 1626 for George Villiers as a watergate for his nearby mansion. Now marooned 100 metres from the Thames, it showed us the extent of the narrowing of the river over the years and the scale of the project that built the Thames Embankment, complete with roads, sewers, parks and, of course, railways.

### Tower Subway

We next headed eastwards on the Circle line to Tower Hill and exited to see what little we could of the Tower Subway. This is the second-oldest tunnel beneath the Thames and was constructed using a tunnelling shield





*Ex-chairman takes a nap*

patented by Peter Barlow. Work began in 1868 and the tunnel was excavated from shafts on each bank of the Thames.

Compared with Brunel's earlier Thames Tunnel, the project experienced few engineering problems as it was contained within London Clay rather than the gravel deposits penetrated by Brunel. In addition, the cross-section was only around a twentieth of the area of the shield employed in the earlier scheme.

Completed in December 1869, the tunnel was equipped with a two foot six inch-gauge railway for a carriage accommodating twelve people at a time that was cable-hauled from one side to the other. This opened in August 1870 but was uneconomic to the extent that it ceased operation due to bankruptcy by the end of the same year.

The tunnel was converted for pedestrians who could cross for a toll of ½d (about a fifth of a current penny). This business was affected by the opening in 1894 of nearby Tower Bridge – which was toll-free – and the tunnel closed for foot traffic in 1898.

A third phase in the tunnel's history followed as it was bought by the London Hydraulic Power Company and used to carry their hydraulic mains. This business eventually ceased but the tunnel then accommodated water mains and later telecommunication cables which it does to this day, now under the ownership of Vodafone.



*Chairman gives a history lesson*

Our viewing point was the northern entrance building which is adjacent to the Tower of London ticket office. Although this cylindrical structure bears the date of 1868, it actually only dates from 1926. In a delightful coincidence, the nearest building to the entrance is a Subway sandwich bar – how fitting!

We could easily see Tower Bridge, one of the structures that used hydraulic power to move the bascules. Other devices that once relied on hydraulic power include cranes, hoists, passenger lifts and even the safety curtains in West End theatres.

Leaving the tourists behind, we walked to Tower Gateway station, entering DLR territory. En route we passed All Hallows by the Tower – the oldest church in the City of London. Rebuilt after World War II damage, it retains an exquisite crypt with 2nd-century Roman mosaics.

### **Docklands Light Railway**

The Docklands Light Railway (DLR) opened in 1987 and is a computer-controlled light railway. Although there are no drivers, each train has a Passenger Service Agent (originally termed 'Train Captain') on board.

Today there was trackside work taking place and so the PSA was at the driving console: not actively driving but there to sound the warning horn for any workers on the line. If the correct acknowledgement is not given (one arm raised above the head), then the PSA would apply the brakes.

En route to Cutty Sark station we passed one of the original hydraulic power accumulator towers. After changing at Westferry we could see the huge and impressive station box for the new Elizabeth line (Crossrail) Canary Wharf station. This is built within West India north dock which was drained using coffer dams during construction. A massive 475 metres long, the station complex includes 17 escalators but exploration will have to wait for its opening next year.

On the southern side of Canary Wharf DLR we could see the entrance to the Jubilee line Canary Wharf station. Opened in 1999 by Ken Livingstone, the station is one of the busiest outside central London. In January 2013 a set of stamps was issued celebrating 150 years of London's underground railways; the newest location represented was of Canary Wharf, on a stamp priced £1.28.

### **DLR Lewisham extension – Crossing #2**

Island Gardens at the south of the Isle of Dogs was the original southern terminus of the DLR. Like most of the rest of the network it was elevated – built adjacent to the former North Greenwich station: itself the terminus of the long-disused former Millwall Extension railway. Work began in 1996 on an extension of the DLR to Lewisham but in order to align with the tunnel needed beneath the Thames, Island Gardens was rebuilt as an underground station, with the neighbouring Mudchute being rebuilt from elevated to street level.

The new line is in cut-and-cover between Mudchute and Island Gardens and then enters the tunnel proper which

runs under the river between Island Gardens and Cutty Sark stations. Two tunnels, each 1,080 metres long, were bored, and completed ahead of schedule in April 1998. The line opened in December 1999.

The tunnels were excavated using a single Tunnel Boring Machine (TBM) which was launched twice from the site of Island Gardens station. The strata include sand and gravel and so pressurised slurry TBM (by Markham of Chesterfield) was employed.

The tunnels were lined with concrete segments and are 5.2 metres in diameter. This is wider than the original DLR tunnel from Bank in order to provide a wider evacuation walkway. The walkways of the north and southbound tunnels are linked at their mid-point.

After an uneventful second crossing of the Thames, we encountered crowds of tourists at Cutty Sark station. Several saw the bright hi-viz jackets of our leader and back marker and launched a series of questions about the best way to Greenwich market, lost Oyster cards etc.



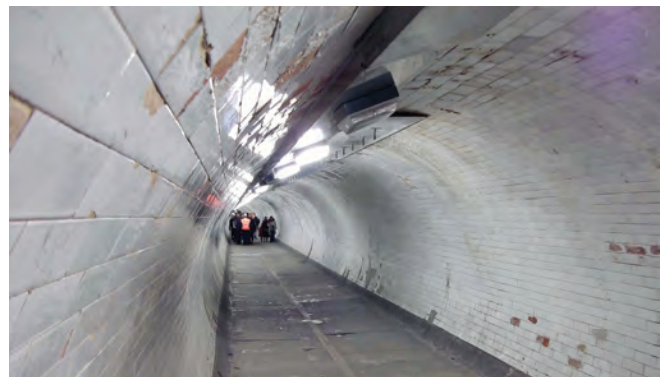
At surface level a semi-circular section of the original TBM head has been preserved and is mounted for all to see, nicely painted up in Union Jack colours. The obligatory group photo over, we all had free time in Greenwich to catch a bite to eat and drink.

### Greenwich Foot Tunnel – Crossing #3

Reassembling after lunch, we descended the stairs into the Greenwich foot tunnel. This was built to replace a ferry service that allowed workers who lived south of the Thames to reach the docks on the Isle of Dogs. Built by London County Council, it opened in August 1902.



*Greenwich foot tunnel south entrance*



*Greenwich foot tunnel*

From outside the southern entrance – topped with a rather grand glass-domed building – we could see its northern companion on the other bank. Spiral staircases wind around lifts that were first installed shortly after opening in 1904. The engineer was Sir Alexander Binnie, also the designer of the nearby Blackwall Tunnel of 1897.

The foot tunnel is 1,215 ft long, 50 ft deep and lined with cast-iron rings. There is a concrete coating and then a surface covering of around 200,000 white tiles. The internal diameter is around nine feet, apart from a section on the northern side which was damaged by bombs in WWII and strengthened with an inner concrete and iron lining. The tunnel now sees over one million pedestrians a year – a step change from the 1970s when I used to live in Greenwich and it was very little used and somewhat unloved.



*Repaired section of Greenwich foot tunnel, following damage in WWII*

An upgrade programme funded by Greenwich Council started in 2010 to install modern lifts, CCTV coverage and better signage. The programme over-ran substantially but has now been completed and some of the last lifts in London with an in-car operator passed into history.

A local group called Fogwoft (Friends of Greenwich and Woolwich Foot Tunnels – <https://fogwoft.com>) was set up in 2013 to represent all users of the tunnel and promote maintenance and continued safe usage. A plaque was installed in 2016 to explain and celebrate the tunnel.

### Rotherhithe Road Tunnel – Crossing #4

Exiting the foot tunnel on the north side of the Thames, we walked the short distance to Island Gardens station, one of only three wholly underground DLR stations (the others being Bank and Cutty Sark). Retracing our route





*Rotherhithe Tunnel north portal*

towards the former, we disembarked at Limehouse for what was to be our fourth and arguably most exciting transit. We walked the short distance to the northern portal of the Rotherhithe Road Tunnel and began our descent. The tunnel was designed for foot and horse-drawn traffic between the docks on each side of the river. It was built by London County Council, and met with some local opposition – most particularly as around three thousand residents were displaced by the construction. It was built between 1904 and 1908 to a design by Maurice Fitzmaurice and cost around £1 million.

The sections under land were constructed using cut-and-cover and under the water a large tunnelling shield was used. This measured 30 ft 8 ins in diameter; the outer edges were retained and are still in place as entrance arches, neatly forming a loading gauge the same size as the tunnel itself. The single-bore tunnel is just less than 1,500 metres long and carries two-way traffic with a pavement on each side. The tunnel now carries over 34,000 vehicles a day and has a 20mph speed limit throughout. Luckily for pedestrians this is policed by average-speed cameras but the proximity of passing wing mirrors and atmosphere of exhaust fumes made for an exciting crossing.



*Rotherhithe Tunnel under construction (1906)*

Four shafts used during construction were reused for ventilation and as pedestrian entrances. These pedestrian

entrances are now closed but the spiral stairs within some could still be seen.

The most southerly shaft houses a vertically mounted World War II flood-gate to protect the Thames Tunnel railway crossing which lies beneath this section. The route includes some tight bends – partially to avoid the docks above and also (it is said) to prevent the portals being visible which might have encouraged horses to bolt (!).



We had hi-viz jackets at front and rear – a number of bicycles and even motorbikes choose to use the footway which we were obviously keen to avoid. An estimated twenty pedestrians a day brave the crossing, so we probably achieved a record for the twenty-first century for the largest number of pedestrians in the tunnel at one time.

### **Brunel's Thames Tunnel – Crossing #5**

Emerging on the southern bank, we ascended the pedestrian steps and walked the short distance to Rotherhithe station. We were to learn of the tunnel's construction history later but for now admired the fine Victorian brickwork and numerous plaques commemorating its historic importance.



*Brunel's shaft at Wapping station*

Now, paradoxically, on London Overground, we took the first train one stop beneath the Thames to Wapping station, thus completing our fifth crossing. The twin portals of the tunnel were clearer from this side, and the arches which separate the lines could just be discerned by the lights of arriving trains. The northern construction shaft for the tunnel still forms the pedestrian entrance at Wapping so we ascended to street level through it.



*The shaft is still in use for platform access*

Photos taken, we returned one stop back to Rotherhithe and walked the short distance to the Brunel Museum. The museum is within the original engine (pumping) house for the tunnel and has its roots in a 1975 exhibition. Today the Museum's director is Robert Hulse and we were lucky to have him on hand to tell us with his customary enthusiasm about how the tunnel was built.



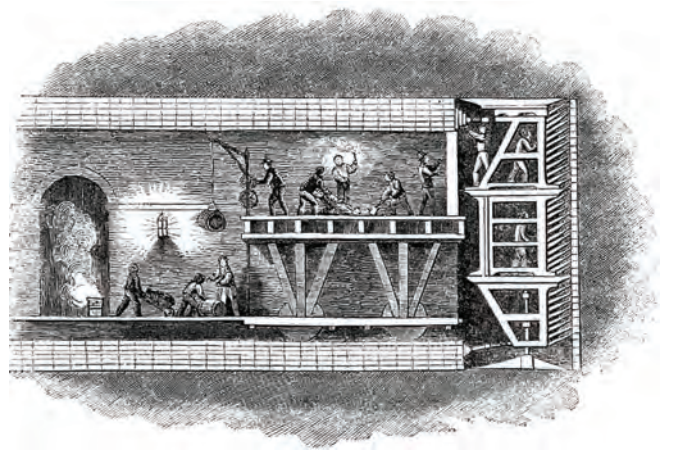
*Southbound tunnel portal at Wapping*

### Thames Tunnel construction

The Thames Tunnel was started in 1825 but it took eighteen long and hazardous years before its eventual opening in 1843. Construction started by sinking a large shaft, now known as the 'Grand Shaft', on the south bank. This was done by assembling an iron ring and building a massive brick cylinder on top (locals wondered why he was building up rather than down!).

Eventually the weight was such that the whole descended in the manner of a giant pastry-cutter. From this shaft the tunnel was commenced, using a rectangular tunnelling shield with 36 cells. This allowed a small section to be excavated at a time and is the forerunner of modern tunnelling methods.

Despite the shield, the tunnel was flooded on several occasions, most notably in 1828 when six men died and



*Tunnellers using Brunel's shield method*

Isambard himself was lucky to escape. Funding ran out and construction ceased completely from 1828 until 1835. Eventually work restarted and the tunnel opened in 1843. The ramps, intended for horse-drawn vehicles, were never built and so the tunnel was opened for pedestrians, using a stairway in the access shaft in which we were listening to Robert.

In its first eighteen weeks, a staggering one million people paid to experience the excitement and novelty of walking beneath the Thames. This was over half the entire population of London at the time. The tunnel became full of souvenir sellers, jugglers and even performing horses (and, apparently, performing ladies).



*Brunel's Thames Tunnel opens for pedestrians (1843)*

When wheeled vehicles did pass through it was after the tunnel had been taken over by the East London Railway Company in 1865. In 1995, London Underground sadly shotcreted over much of the original structure but its Grade II\* listing ensured a few pillars remained untreated.

### Sub Brit's contribution

The Grand Shaft itself has now been floored over and serves as a performing and entertaining space for the adjacent Brunel Museum. In June 2014, Sub Brit itself held our 40th Birthday Party in the shaft and supported the installation of a new improved stairway to provide access for all; one step has a small plaque recording our donation.





*Sub Brit's 40th birthday party, June 2014. Photo Nick Catford*

Brunel's Thames Tunnel was the first in the world to be constructed beneath a navigable river. It was built for road traffic, opened to pedestrians and now forms part of London's complex rail network. A visit to the museum above brought a fitting end to our fascinating day beneath the Thames.

**Editor's note:** As a result of our donation, we have available a number of copies of *The Brunels' Tunnel*, a highly-recommended book that tells the whole story of this remarkable engineering feat. It is available from the Shop at our Sub Brit website, only £5.00 per copy, plus postage; 84 pages, fully illustrated, 21cm x 20cm.

New photos by Ade Armishaw unless stated

## Death of John Collett [1936 – 2017]

John and Rosemary Collett were known to many members who attended Subterranea Britannica Day Conferences and Study Weekends at home and abroad. Sadly, Rosemary died very suddenly and unexpectedly a few years ago. John died aged 81 on 6 October 2017 after a prolonged stay in a care home in west Surrey.

John Ambrose Collett was born in Canterbury in 1936, but grew up in Norbury, south London, and attended Whitgift School in South Croydon. He trained as an engineer at Northampton Polytechnic and in due course was the proprietor of Foster Magneto in South Norwood, a light engineering company. He married Rosemary in 1972 and they set up home in South Croydon, later moving to Limpsfield Chart near Oxted in east Surrey where they moved into a disused Army hut which in due course they replaced with a more conventional home on a five acre site. Their final home was a farm of 50 acres in South Nutfield, where they then became near neighbours of former Subterranea Britannica joint secretaries Barbara and Malcolm Tadd. John and Rosemary had

already, in the 1970s, been introduced to underground exploration by former Chairman Paul Sowen as a result of attending evening classes on industrial archaeology which he conducted. By the time they had moved to South Nutfield John gave up his engineering business and turned to sheep farming. He had many other interests besides underground exploration, which he pursued through membership of many other societies such as the Croydon Natural History and Scientific Society, the Domestic Buildings Research Group (Surrey), the Newcomen Society, the Surrey Archaeological Society, and the Wealden Iron Research Group, of most of which Paul Sowen is also a member. Other enthusiasms, shared with Rosemary, included bee-keeping, and exploring Britain's canals in their canal boat. Their article about the canal and railway tunnels at Standedge will appear in a future issue of *Subterranea*. Our society was represented at Rosemary's funeral at South Nutfield, and at John's at St. Oswald's Church in Norbury where he had been baptised 81 years earlier.



## Subterranea Britannica : Study Weekend Budapest Friday 11 – Monday 14 May 2018

Chris Gray, a Sub Brit Committee member, has suggested a trip to Budapest this year. Planning is still at an early stage, but suggested sites include (the list is not guaranteed and may well change)



Buda Castle Hill underground – including a hospital, shelter and labyrinth



Kobanya cellar system (old limestone mine)



Sopron Museum of Mining



Rakosi Nuclear Bunker



Gellert Hill Caves



Etc.

You will need to make your own travel arrangements to/from Budapest; other travel during the weekend and meals will be arranged. This year we will be offering an option without accommodation, in case you wish to find your own place to stay. For those who wish, we will be booking a convenient hotel for the group. Cost expected to be about £250-300pp (including 3 nights, accommodation in a shared room; approx. £150 without).

### **This year we will again be taking bookings online**

- All attendees must be members of Sub Brit for insurance purposes.
- Ensure you renew your membership for 2018 promptly.
- You must be 18 or over to attend, or be accompanied by a parent/guardian.
- If you do not have access to the internet, then please send a letter expressing your interest to our registered address.

### **The trip will be advertised by email to members**

This will happen once we have got more details and have firmed up on dates and times, hopefully during January.

- Log on to ‘mySUBBRIT’ at <https://mysubbrit.org.uk> & click on ‘Register for event’.
- When you book you will be asked for the following:
- If you wish to join the SB group in a hotel and type of hotel room (single, double or shared)
- any food preferences (vegetarian, gluten-free etc.)
- to pay a deposit of £50, preferably by PayPal. Full payment will be requested about six weeks before the trip, this will be by cheque or bank transfer (to avoid excessive Paypal charges).

Acknowledgement of your booking will be by email. Full joining instructions will be sent just before the trip.

Keep up to date with Sub Brit Events by choosing to receive emails from the Sub Brit Forum – see Issue 39, page 24 of *Subterranea* for how to do this.



# Sub Brit's Dover and France weekend, July 2017

Vincent Stenhouse



*Collapsed roof section off main tunnel at the Mimoyecques V3 site. The Sub Brit party is seen in the distance.*

*Photo Clive Penfold*

## Day One – England

### An entente not so cordiale

With France being the source of mistrust and our enemy over many centuries Dover, just twenty miles from the French coast, has an equally long history of fortification. Dover Castle, with its origins stretching back before the Norman invasion, was a formidable defence for this key strategic port but was itself exposed, especially from the unprotected higher ground to the north.

General Sir John Burgoyne (Inspector General of Fortifications 1845–68) highlighted this in an 1856 memo and later reports pointed out that France's newly adopted rifled guns could breach the castle walls from up to 2,000 yards.

With the high ground being just 700 yards away, their concerns fell on receptive ears, this being the time of great uncertainty about France's intentions; Lord Palmerston, the Prime Minister of the day, whilst fostering good relations with the French, did not trust them. A Royal Commission was instigated and it

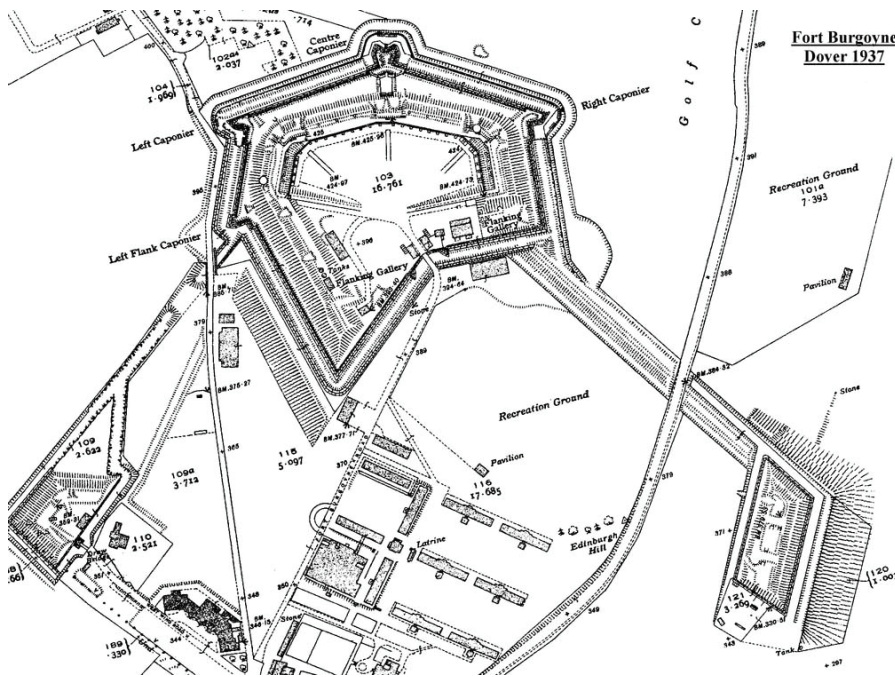
decreed that the Dover defences, along with other sites on the south coast, should be extensively upgraded, with a new fortification built to protect the castle.

### Fort Burgoyne



*Fort Burgoyne casemates, accommodation below behind WWII blast walls, central Haxo above. Photo Bob Clary*





*Fort Burgoyne plan showing outworks, with Connaught barracks between*

Designed by Captain Edmund Du Cane RE, construction of Castle Hill Fort began in June 1861 using military labour; despite chalk being an amenable rock to work, building was not without issue, as pockets of clay were found and local subsidence required repair with concrete, a problem that never went away. Work completed in 1868 at a cost of £88,053, and when Burgoyne died in October 1871, Castle Hill Fort was renamed after him. The works are in the form of an irregular heptagon, 280m across, dug out from the chalk, surrounded by 600m of ditch 10m in both depth and width, in which are four caponiers (from the French for ‘hen house’) that provided enfilading fire along them. The surface level is surmounted by a 15m high earthen bank in a horseshoe oriented towards the NNE, but absent from the south, this being added after the building of the casemated living areas, magazines and storage rooms below.



*Central Haxo casemates with shifting lobby between, WWII blast walls evident within. Tunnel through to central caponier below. Photo Bob Clary*

On top of the bank are the raised ramparts and behind that the terreplein or fighting platform where the guns would have been. Dominating this upper level are three

open-backed double Haxo casemates (free-standing casemates on top of ramparts, named after French military engineer Baron Haxo), these hosting the main armament of the fort.

### **G Heavily armed, then not**

With this fort lacking any adjacent forts to protect it, defensive structures were added in outworks to east and west and the ditch extending out to them, these also shielding the Castle from attack.

Armament for the site was to be 29 guns on the terreplein plus 24 in the caponiers; the outworks were to house nine, five to the east and four to the west, able to fire in all directions, covering all approaches. The complement to fire these guns was 270 men and seven officers, housed in the ‘bombproof’ casemates beneath the earth ramparts.

With the threat from France diminishing in 1870 due to the Franco-Prussian war, the number of guns was reduced; typical armament became 6 x 7 inch rifled breech loading (RBL) guns in the three Haxo casemates providing the main defence, plus a variety of smaller guns on the terreplein and 16 x 24 pounder carronades in the caponiers, these firing mixed shot for local defence. The Haxo casemates were deemed superfluous by 1886, de-gunned and converted to enclosed storage spaces.

By 1900 the site was disarmed, with the big guns sold for scrap in 1902 – the policy here and across the Dover defences being that field guns, eminently mobile, could be used should the need arise. Military planning had by then moved from fixed fortifications to mobile warfare and the site was relegated to being used for storage and accommodation.

### **O’er the ramparts we wander**

On arrival, little is revealed of the scale of the structure other than a small section that flanks the bridge in the ditch below; the semicircular parade ground 100m further on is bordered by 27 enclosed brick casemates similar in form to railway arches, with earthen ramparts above and gun ramps at either end. It is striking just how open and exposed the whole area is but visible through the trees to the south is Dover Castle, a reminder that the site was designed to offer no threat to the castle if overrun, and to be vulnerable to bombardment from there should it be.

After a briefing by our Land Trust volunteer guides, we headed for the bridge. Now a fixed structure, there would originally have been an inner drawbridge, the whole protected from below by two dual-level gorge flanking casemates, the guns of which pointed directly at the bridge supports just 10m away – perhaps a design error, perhaps intentional to topple the bridge into the moat if threatened.







*Burgoyne's 20C entrance bridge, the four flanking casemates below. Photo Clive Penfold*

Each group was then led in turn up the gun ramp to the right flank, the magazines below well protected from bombardment.

On the flank, amid the heavy undergrowth, are numerous chimney stacks and air vents from the casemates below, and a World War I-era gun house. On the northeast face of the ramparts are the Haxo casemates, their beautifully crafted brick-built double arches buried in earth and separated by an expense magazine that would once have held 180 barrels of powder.



*The NE Haxo casemates, shifting lobby to the magazine between them, recess visible in leftmost casemate wall held shells as far from powder as possible. Photo Clive Penfold*

A small room before the magazine was the shifting lobby, where crew changed from uniform to a plain calico suit; understandably no metal was allowed past this point. Internal concrete blast walls in some showed World War II use as machine gun positions. Atop the centre Haxo is the flagpole and those flanking it have rudimentary anti-aircraft gun positions on top, fashioned by burying Victorian cannon vertically as a gun mount.

### Bricks and mortars

Returning to ground level and passing under the centre of the casemates to stand above the centre caponier, the true extent of the fortifications is revealed. Massive brick walls are below to left and right, many since repaired extensively with concrete due to the unstable chalk. A sally port below in the central caponier allowed forays over the bridge, up steps to firing positions.



*Improvised twice, a WWI AA gun mount made of an old cannon later enclosed as a WWII pill box. Photo Clive Penfold*

Either side, the 'chemin de ronde', or patrol path, runs right round the fort at the same level as the parade ground. On this are six WWII cast-concrete circular gun emplacements, part of the Dover defence scheme, one of which still shows bearings of local targets on the back wall. Round to the west, at the point where the road runs just beyond the ditch, a WWII Fougasse flame barrage would have given German invaders a very warm welcome.

A tunnel through the ramparts at this point led to a lighting passage, a space alongside the second main magazine that held lamps to illuminate it through plate glass windows. A WWII pill box overlooks the site of the now demolished guardhouse and cells where troops returning with an unsteady gait or a lady of ill repute would have spent the night.

### Accommodation

In the casemates, the seven soldiers' quarters that would once have held eighteen men each were joined at the rear by a corridor, and show their later use as a school with cartoons painted on the walls. The officers' quarters occupy the easternmost range of four casemates, with four more below parade ground level for stores and servants.



*Ablutions casemate showing recent use as battery charging station for Connaught barracks. Photo Bob Clary*

Accommodation here was elegant in comparison to that for the soldiers, with a dumb waiter, a pantry and dedicated rooms for plates, beer and wine. The wooden panelling



*The barracks school room which once housed 18 soldiers.*

*Photo Bob Clary*

and heavy oak doors are still in place, suggesting a refined abode befitting the gentry that made up the officer class of the day, indeed this corner of the fort was used as offices right up to when the military left in 2006.



*Interconnecting tunnel behind NE casemates*



*Gun ramp heading down to the right caponier.*

*Photo Bob Clary*

Off the rooms below, a tunnel leads down to the right caponier, a dual-level room, the wooden flooring now largely absent, for four carronade with flanking galleries for riflemen. Also incorporating a shifting lobby and magazine, these rooms shared a fireplace and would have been used as barrack rooms during a sustained attack. Restraining rings on the walls would have been used to return the guns to their firing position after recoil, and the rare remains of an original wooden cover still partially shield an embrasure.

Heading back into daylight, our visit over, we thanked our Land Trust guides and headed off across town.

### **The Western Heights – North Entrance**

Going on to form the bulk of Dover’s Georgian and Victorian defences, the fortification of the Western Heights had begun around 1770 but was given fresh impetus when Napoleon began amassing an invasion force at Boulogne in 1803. By 1804 work began to create a large system of forts and deep ditches (lines) to accommodate and protect the 5–6,000 men who would defend the harbour.

The ditches, around ten metres deep and the same across, run for several miles on all sides of the high ground, only being absent where natural cliffs performed the same function. Two entrances to the fort complex were provided to north and south and it was the North Entrance we turned our attention to next.

### **Short and winding road**

A sloping road in a cutting led to a magnificent facade with two red and cream brick arches, one containing the guardroom, the other the road through the ramparts to the bridge. The roadway inside is formed of wooden blocks set in tar; this designed to keep the noise of horses’ hooves and cartwheels down. Many of these wonderfully combustible blocks have sadly since been purloined (some quite recently) to warm the locals.



*Just inside the north entrance portal the road turns to the left. Photo Bob Clary*

An elliptical brick shaft set in the roof provided the only natural light until, on reaching the other end after about forty metres, daylight is seen through the remains of the closed wooden drawbridge, its counterweight recess and original winch below.





*North entrance tunnel; passageway to lower level to right, elliptical air shaft above, the road deck missing many of its wooden blocks. Photo Bob Clary*

Out beyond this, visible through the dense foliage that has reclaimed the area, are the bridge supports and the tenaille, a raised outwork in the ditch. That in turn once hosted another drawbridge over a second ditch, this designed to drop down rather than to rise, on the basis that an enemy could grapple a raised bridge down to gain access but could not grapple a dropped one up. The two bridges were deliberately not aligned, a sharp and deeply revetted dogleg on the tenaille preventing cannons blasting the inner drawbridge from across the lines.

### Defending the entrance

The North Entrance was no passive portal; it was heavily defended with firing positions on the ramparts above, on the far side of the ditch, and on the tenaille, with the last



*North entrance, the heavy wood and iron doors to the galleries below. Photo Clive Penfold*

line being within the curtain wall to the east. An arched doorway to these defences, a few metres into the tunnel, still retains parts of the original thick timber and iron doors that would have been barred to deny access even if the tunnel were taken. A set of steps led down, their sides incorporating wheeling platforms; these, along with the iron rings set into the walls, allowed haulage of the heavy carronades.

The lower rooms comprise a shifting lobby, two small magazines and three 12 x 6m gun rooms, each with a carronade embrasure, a pair of musket loopholes and a fireplace at the rear. This collection of arched brick rooms, painted white throughout, was fitted with electric lighting and used as a telephone exchange from around 1912, with a door being cut through to the ditch to ease access.

The North Entrance in time became a bottleneck that prevented development of the area, and was last used in 1967, when a new bypass road was built through the lines. During this construction, two water tanks were breached and, cultural sensitivities being what they were at the time, these convenient voids offered a great place to shove the spoil, so they did, though thankfully they left one of them intact.

### The Western Heights – Drop Redoubt

What does the word ‘drop’ refer to, I wondered, as we made the short walk from the North Entrance. The word redoubt, meaning a place of retreat, gives away the original intent of this site – it was itself not armed, but there to control two sets of defences on the lines either side of it; in the event of these being overrun, the fort was to be a defensible refuge for the soldiers. Adding to an original fort started in 1782, building began in 1806 and was completed by 1810.



*Now the only way in to the Drop Redoubt, single file and bent double. Photo Clive Penfold*

The Drop Redoubt is now accessed via a low single-file tunnel through to a deep ditch and straight into what was the firing line of its southwestern caponier. Up above the south curtain wall the arched main entrance, still bearing the fort’s name, would have been accessed across the ditch by a swing bridge and a fixed bridge section, the supports of which survive.



*Entering the Drop Redoubt from the lines through the sally port. To right the NE lines head down to the coast, to left carronade portals cover that approach. Photo Clive Penfold*

Our entrance was through the heavy studded wood and iron door of the sally port on the eastern face, loomed over by the east caponier. To the left are three gun rooms that once contained the 24-pounder carronades that fired shot down the lines to the southeast and to the right is the caponier entrance. Straight ahead a steep tunnel leads up steps to the surface, emerging in a recessed accommodation area shielded by the ramparts.



*The Drop Redoubt - Northeast line that runs down towards the coast. Photo Clive Penfold*

### Surface accommodation

Dominating this surface level are the parade ground and the five parabolic arched 15 x 6m casemates, just four of which were destined to accommodate 200 men, giving a man less than two square metres of floor space, though this was amended later to just 25 in each; in turn one of the casemates was later used as married quarters.

The casemates would have had wooden walls internally for privacy and were fitted with storm porches, both features long gone along with the front walls that held the doors and windows, though a few fittings in the walls remain to show where metal bed frames and racks were attached.

Down a set of steps from the parade ground and into a cutting are seven casemates on the east side and three to the west, with the main entrance ahead. The handful of officers enjoyed superior accommodation in the seven small interconnected casemates, each with a fireplace,



*Aerial view of the Drop Redoubt showing accommodation casemates, ramparts and caponiers*

and they of course had their own privies. Intriguingly, the rear wall of one of these rooms is of flint masonry, possibly part of the remains of the Roman lighthouse that once occupied the site.

Over the way, the guardroom in the central casemate is flanked on one side by a pair of cells for those having received military justice and a lock-up the other side for those awaiting it. Barred windows, still apparent, would have been matched by heavy doors, with heating being provided by ducting hot air from a stove in the guardroom.

To the south of the parade ground a tunnel leads to the magazine, originally a surface structure but later buried, with an adjacent shifting lobby and a lighting passage running right round the outside.

### Underground, sort of

At the back of two of the accommodation casemates, tunnels lead down to the no2 and no3 caponiers. With each caponier being dual-level, the ramps split toward the bottom to allow a party of troops, at full speed, to go to the left, another to the right and the rest straight ahead to man the lower positions. Each caponier is in the form of dual two-storey arched casemates, covered in earth and brick-faced, with numerous musketry and carronade embrasures at each level.



*Caponier interior, original slanted musket embrasures above, WWII era firing slots below right, the carronade embrasures bricked up. Photo Clive Penfold*

A wrought-iron internal structure provides support for the upper level slate flooring, and each level has flanking musket galleries along the curtain walls. One or two expense magazines, sized for up to 45 barrels of powder, are provided in each caponier, these being dug into the chalk right at the back and fitted with narrow lighting passages.

Up at the top level, it is clear what a commanding view of Dover the fort has and it's on this terreplein behind the ramparts that the 7-inch guns were mounted in eleven emplacements, with ready-use ammunition lockers between. As with most of the sites of their era, disarmament took place in the late 19th century, just two of these guns being in place after 1893.



*High above Dover on the Drop Redoubt ramparts. Roof of accommodation casemate to left, parade ground lower middle, small arms store on opposite rampart; the grass mound protects the magazine below. Photo Bob Clary*

### Mystery solved

A vaulted small-arms store lies centrally above the officers' quarters, and nearby a small heap of stones from the Roman lighthouse, referred to for centuries as "the devil's drop of mortar", explains how the place received that name.



*The officers' quarters with small arms store on ramparts above. To its right is the 'Devil's drop of mortar', the remains of one of a pair of Roman lighthouses, the other being in the grounds of Dover Castle. Photo Clive Penfold*

The Drop Redoubt went on to host an AA gun during WWI and then in WWII a barrage balloon, with an

artillery observation post atop the magazine along with a system of slit trenches, still evident today. At this time the fort also held a force of commandos whose job it was to destroy the harbour at the first sight of a German invasion and for that they needed the shortest possible route down there....

### The Grand Shaft

Just to the south of the Drop Redoubt were the Grand Shaft barracks, now open ground with a track down to the final site of the day. The Grand Shaft was built in response to the expected invasion of 1804, concerns having been raised that despite the barracks being just 300 yards from the sea, troops would have had to march over a mile along chalk tracks, treacherous when wet, then through the South entrance to engage the enemy.



*Presented with the choice of three staircases down the Grand Shaft, the group agonise over which is the best to take. Photo Clive Penfold*

The path leads to a flight of steps that then splits into two to reach the circular terrace around the shaft. Wrought-iron railings separate the entrances to three spiral stairways arranged around a circular vertical 43m shaft; each with a small landing and barred window every thirty paces or so. At the bottom of the shaft a tunnel leads towards the coast past a guardroom and through an archway to the road.

The Grand Shaft was designed to allow the entire garrison to be sent two abreast down those stairs in minutes, though with hundreds of excited soldiers, each with a bayonet and wearing slick muddied boots, hurtling pell-mell down the steep stairs, the potential for calamity must have been significant.

The need for this kind of rush never materialised, and the Shaft went on to be the standard way in and out of that section of the Western Heights fortifications. With the more permissive Georgian age giving way to prim Victorian sensibilities, the three separate staircases fitted nicely (and probably apocryphally) with the rigidly enforced rank structure; officers and their ladies using one, NCOs and their wives another, men and their 'women' using another.





*The light well of the Grand Shaft showing three spirals of 'borrowed lights' that illuminate the stairs.*

*Photo Clive Penfold*

All would equally have to endure the stench of the sewage that was piped through the shaft, and the horse manure-enriched run-off from the land above – the shaft wouldn't have been a pleasant place to be at times. Nice brickwork though.

### **Follies to some**

The grand scheme of seventy new and improved defences for strategic sites brought about in the 1860s became known as "Palmerston's Follies", with much criticism being levelled at the many guns pointing inland when the enemy would have come from the sea, and the sheer cost. This is unfair, as Dover may have been a secondary objective and these defences were built to prevent a flanking attack on the port from a landing further along the coast.

The message to the French was clear – any fight on our soil would now be much harder. We'll never know if France would have invaded had these defences not been in place, but it would have been folly indeed to risk that happening.

Follies or not, they made for a great day of exploration and discovery for 43 Sub Britters with many thanks going to the Land Trust and English Heritage volunteers who helped us interpret the sites. At the end of this long tiring summer Saturday, thoughts turned to home for some, hostelries for others; for many this was just the first of two packed days, and with an early start on Sunday there was little scope for carousing.

## **Day Two – We're in France**

### **Dimanche sous la Manche**

The two sites on the second day of this Folkestone-based weekend stand in stark contrast to those of the first. The Palmerston forts seen yesterday enjoyed over a century of use; today's sites were not even finished, being started and abandoned in a year or less, but no less fascinating for that. Both were on an awesome scale that was matched only by the sheer hubris behind them; in the end neither was allowed to fulfill its devastating purpose.

After a day of bricks, it was time for a bit of concrete and my word, there was plenty of that. At 0700 on a Sunday morning, 36 Sub Britters boarded a coach at Folkestone and headed for France via the Tunnel; a short hop down the autoroute brought us to the first of two WWII sites, the extraordinary V3 site at Mimoyecques. It's an unassuming site at the surface, with a portacabin gift shop and a rough railway tunnel portal into the chalk, but this modest opening led on to what was going to be the weapon to wreak, in the words of Churchill, "The most devastating attack of all" – the Nazi supergun.



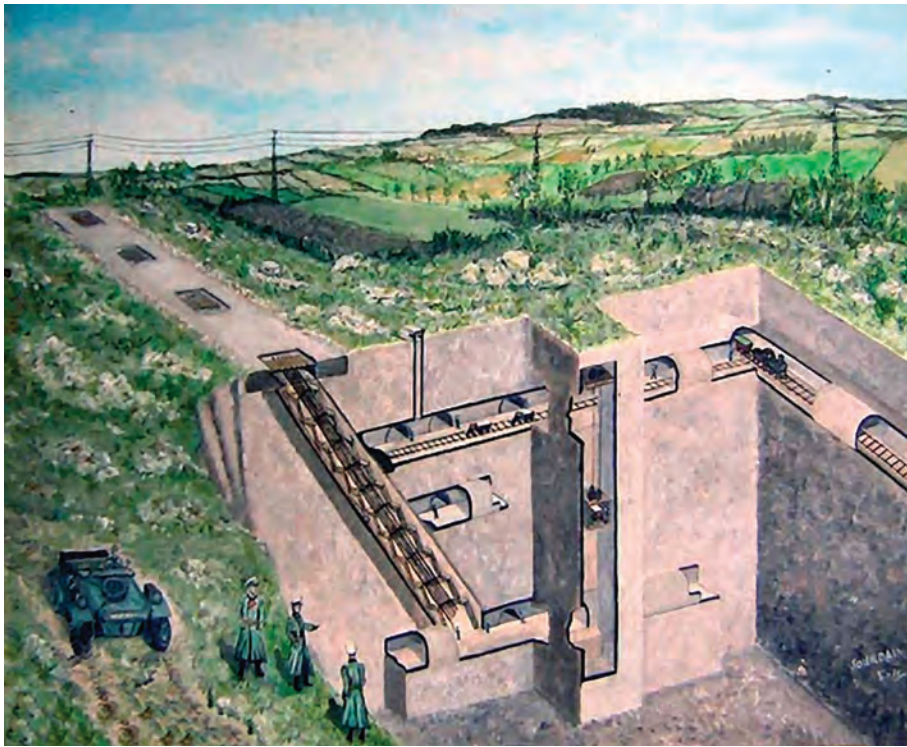
*The entrance to the tunnel complex is now thirty metres in from the site of the original portal due to the demolition and subsequent re-excavation. Photo Clive Penfold*

### **An unstoppable weapon at an impregnable site**

By 1943 the tide of the war was turning in the Allies' favour and with vengeance on his mind, Hitler approved wholeheartedly when supergun plans were taken to him – the shells would be unstoppable, London could now be annihilated!

Plans were drawn up using codename *Wiese* (meadow) to install guns on two hillside sites one kilometre apart near Mimoyecques, this area being chosen as the layer of marled chalk there is easily worked and was deep enough for the barrels and access tunnels. The full installation was to be fifty guns, each site having 5 x 127 metre barrels stacked in each of five drifts, angled at 50 degrees into the hillside, pointing towards London. Supplying the sites were standard-gauge railways that ran into the hillside, with a labyrinth of tunnels at 30, 47, 62 and 105m below ground, connected by lift shafts and drifts.





*Concept watercolour of the V3 site*

section of which is on display at the entrance. With the slab camouflaged and each with just 25 small orifices that wouldn't be visible from height, air attacks were expected to have little effect, this being at the stage of the war when bombs were relatively small and accuracy was poor. Each of the fifty barrels was to have a calibre of 15cm, and each shell weighed 97kg, around 9kg of which was explosive.

Range was intended to be around 165km and varied by altering the amount of propellant so that acres of London could be laid waste. To achieve this extraordinary range, the initial charge of 5kg was boosted by 24 additional charges totalling 68kg evenly spaced in side chambers along the barrel; as the shell rose up the tube the hot gases would ignite these to increase the velocity to the required 1500m/s.



*Prototype Gun Poland 1942 - An early supergun prototype at the Baltic test site, side charges arranged transversely; this was later revised into a more powerful slanted arrangement*

To protect the guns from attack, their muzzles were sub-surface and fired through a 5.5m thick concrete slab 30m wide, faced with heavy steel armour, a 65-tonne

### Rapid progress and a rapid demise

Work began in September 1943 using 5,000 workers, mostly enforced foreign labour, but the sites were spotted straight away by British reconnaissance aircraft after a tip-off from French spies. It was now just a matter of time before it would be attacked.

Work continued rapidly at the eastern site, less so at the western, so when the attack came in November 1943, the western site was abandoned. Meanwhile, over at the test site on the Baltic, full-size guns were being fired and found wanting both in reliability and performance – the muzzle velocity of 1000m/s was just too low to deliver the range.

The scale of the site was reduced to just fifteen guns due to this and when, after months of raids, a recently developed British 'Tallboy' earthquake bomb penetrated the concrete slab on 6 July 1944, the viability of the site was lost completely; Canadian forces overran it two months later.



*Memorial to RAF crews lost whilst bombing the site, evidence of their work behind. Photo Bob Clary*

With thoughts of a German resurgence and a possible future threat, senior British figures decreed the site had to be destroyed; 35 tons of explosives did the job, bringing down both railway portals. The slab above the site was similarly demolished. A later version of the gun was to demonstrate a maximum range of around 100km, suggesting that if the Mimoyecques site had been allowed to become operational it may well have given Tunbridge Wells a hard time but not London, though at 9kg per shell, it may have taken a while.

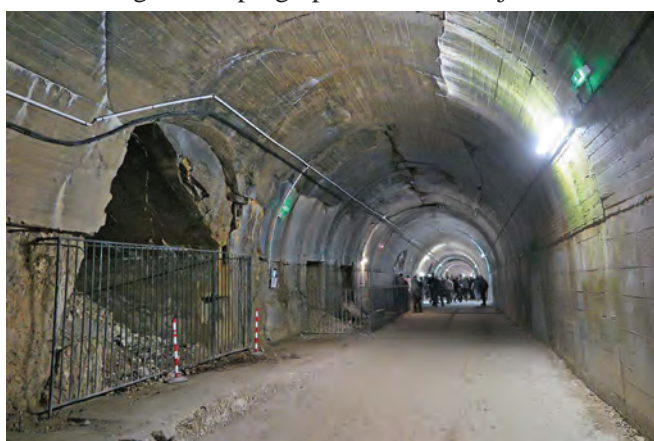
### Underground and unfinished

The entrance is now thirty metres in from the site of the original portal due to the demolition and subsequent re-excavation, the armoured steel doors that would have protected the entrance now long gone. Within this main 630-metre roughly north-south railway tunnel, piles of rubble beneath roof falls and pock-marked concrete walls bear witness to the post-capture destruction.



*The main N-S railway tunnel, cross tunnels and loading platform to left. Photo Clive Penfold*

A few hundred metres in, eleven 100m-long tunnels at 24m intervals lead to a 250m gallery that runs parallel to the main tunnel; off this are the drifts that would have hosted the guns, sloping up to the surface just above.



*The gallery at Mimoyecques, a partially excavated slope shaft to left, likely abandoned when the scale of the weapon was reduced. Photo Clive Penfold*

All of the tunnels are around three to five metres in width and height, most being designed for narrow-gauge railways that would have delivered the thousands of shells and charges required by the guns. At the

southern end of this gallery, out of bounds to us, a drift leads steeply down a considerable distance eastwards and another heads south to what would have been the pedestrian entrance, now blocked.



*A soot blackened unfinished drift reveals layers of flint within the chalk. Photo Bob Clary*

Of the five gun drifts, two are barely started and three are more complete; of these, one has daylight streaming in from the hole made by the Tallboy strike and in another is a mock-up of one of the guns, its fishbone-like structure and small diameter clearly discernible.



*A mock-up of the super-gun shows the slanted booster charge arrangement. Photo Clive Penfold*

Moving through the tunnels, it can be seen just how vast but unfinished it all is; in places are excavations that would have become offices, storage rooms, living spaces, and in some the eerie relics of the time (and perhaps the place): tools and utensils, weapons and engines. After reaching the end of the public tour, our



guide very kindly took us into an unlit off-limits area that ends at the rubble blocking the northern entrance, the darkness accentuated by the soot from the trains that once ran through this tunnel, the only part of the site that was ever functional.



*Winning photo in the brightest torch category, an unfinished cross tunnel stained by the soot from trains and demolition.  
Photo Clive Penfold*

The tour ended at this level, with no mention of anything further down, though the slope shaft viewed earlier leaves one wondering what lies beneath. There are rumours of slave labourers who were trapped during the Allied bombing who still rest below.



*Demolition rubble at the site of the north portal.  
Photo Clive Penfold*

In the scrubland above the works, the slab lies barely recognisable, smashed into a multitude of large pieces; all around the land is deeply cratered, testimony to the many thousands of bombs dropped there, that in itself an indication of how grave a threat the site was seen to pose. Before its opening as a museum, Mimoyecques housed mushroom production in its darkened tunnels.

### **Watten (awful lot of concrete)**

After a 30-minute drive we arrived at the Blockhaus d'Éperlecques, near the village of Watten. This site was carefully chosen by the Germans as it nestled under a ridge to the north, was out of naval gun range, had electricity nearby and was close to sand and gravel quarries – a big consideration for what was to be an enormous concrete structure designed to protect, fuel and launch A4(V2) rockets.



*The western and southern faces of the blockhouse.  
Photo Bob Clary*

The development of the V2 wonder weapon began in 1939, it was all but ready in 1943, and deployment options had to be considered. One option was mobile launchers, and that went on to be the standard later in the war; the other option was to use large hardened shelters, these also being able to produce and store the large amounts of liquid oxygen (LOx) required for each launch.



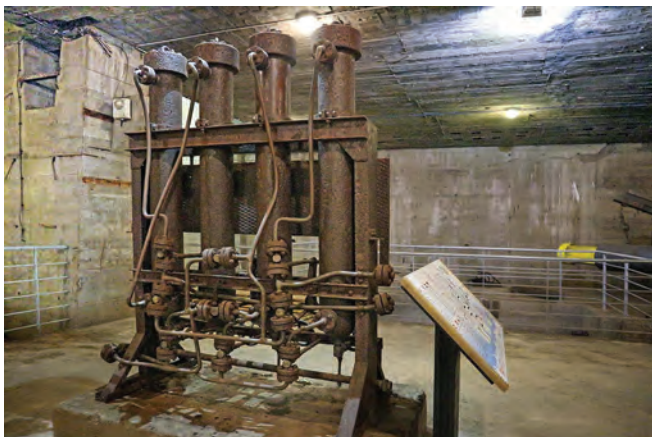
*Trackbed of what was to be the fortified train station, transit halls to right. Photo Bob Clary*

Construction of the Blockhaus started in March 1943, with 6,000 mostly slave workers working 24/7, the site comprising the 92m long and 28m high main building with walls up to 7m thick, a fortified storage area and a hardened railway station to the north. This was to extend hundreds of metres to the west, allowing trains loaded with empty missiles and warheads to arrive and be unloaded safe from air attack.

In all, Watten was to consume 200,000 tonnes of concrete and 20,000 of steel. Producing 50 tonnes of LOx per day and storing 150, the bunker was intended to hold 108 rockets and fire 36 every day, the target being southern England.

The bombers came in August 1943, cleverly attacking while some of the concrete was still wet; this and other attacks on the railways the site depended on ended plans for all but LOx production.

The main structure was continued by first creating the 5m thick, 37,000 tonne roof, then jacking it up to use it as a shield, building the walls beneath. Incredible though this



*One of five Heyland compressors at Watten, each capable of producing 10 tonnes of LOx per day. Photo Bob Clary*

feat was it was proved pointless by a devastating Tallboy strike in July 1944. With Allied forces bearing down, the site was abandoned, and then captured in September.

### Round the block

Our tour began with a briefing from the young and rather stern female guide on the war, the site, the effect on local forestry due to shrapnel in the trees, and (perhaps pointedly) the benefits of European unification. With many eager to see the bunker, her work was cut out rounding us all up but she did, mostly, leading us past various guns, vehicles and an incongruous Japanese midget submarine, this being a general WWII museum as well as Nazi megastructure.



*Being briefed by our guide at Watten. Photo Bob Clary*

Through the injured but since unmolested trees the huge shoe box-shaped monolith of the main structure loomed above. On the southern face is the sloped protrusion that would have been launch control, and on that and the eastern wall there are multiple circular intakes for the LOx compressors; also on the east wall is another sloped structure to shield the railway entrance into the bunker.

Out from the northern wall are the shattered remains of the storage area, transit halls and the fortified railway station, all flooded, the base of this area being 6m below ground as was the basement of the bunker. We entered the bunker through the armoured sliding door of the western railway entrance; inside there is a large U-shaped servicing hall between the outer wall and an inner structure where the LOx was produced.



*The north wall and in the foreground the shattered remains of the transit and servicing halls. Photo Bob Clary*



*Inside the blockhouse servicing hall, North wall at L, wall of the LOx plant to R, walking where locomotives were to shuffle rockets through the stages of preparation.*

*Photo Clive Penfold*

A full-sized V2 shape positioned on the southern wall shows where there was intended to be an opening where rockets would have been sent through, fuelled and launched, there being another on the other arm. Upstairs in the inner structure is one of the original compressors and the penetrator of a Disney bomb tested there and found stuck in the roof, this being named after a cartoon missile in a propaganda film Disney made.





The life-size V2 shape shows where a door to a launch pad was planned. The reflection below is off water, the bottom 6m being flooded. Photo Bob Clary

Hanging from the corrugated iron-clad ceiling is a full-size model of a Tallboy bomb, back outside the impact point of one of these has taken a huge chunk out of the roof; without penetrating it also managed to wreck the interior. Rebar rods poking out the south wall show where extensions were to have been.

### Reflections

Overall the V-weapon sites could be seen as a waste of time and effort, indeed Churchill thought Hitler's meddling in military affairs to be a great asset to



South wall of Watten, showing the successive layers of concrete poured beneath the jacked-up roof and twisted rebar where the control room was to be, LOx vents to right and severe bomb damage above. Photo Vincent Stenhouse

Britain's war effort. For all their grand promise, the sites were a diversion of resources and provided fixed targets for attack. In contrast the rather cheaper British Tallboy, designed by Barnes Wallis, rendered all hardened surface structures utterly vulnerable, ending Hitler's vengeful dreams and helping make the V-sites perhaps the greatest military follies of all time.

Many thanks to Tony Radstone for originating and planning this fascinating weekend and to Tim Wellburn and all our guides for bringing the sites to life.

### References:

*Fort Burgoyne, A Dover land front fort*, David Moore, EAN 9780-9570302-6-8

English Heritage Western Heights reports Nos 3,4,6; Paul Pattison, Moraig Brown and Andrew Williams - ISSN1478-7008

Wikipedia for the French sites.

**Editor's note:** An account of a previous Sub Brit visit to the Éperlecques bunker appeared in *Subterranea* 20 (September 2009), page 36, and an article about Peenemünde and the Vengeance Weapons was in *Subterranea* 32 (April 2013), page 21.

## Underground in Croydon, London

John Aubrey [1626 – 1697] recorded in his *Brief lives* a curious fact about William Harvey [1578 – 1657], the discoverer of the circulation of the blood. Aubrey noted of Harvey that ...

He did delight to be in the darke, and told me he could then best contemplate. He had a house heretofore at Combe, in Surrey, a good aire and prospect, where he had caves made in the earth, in which in summer time he delighted to meditate.

This was in fact at his brother Daniel's house in the hamlet of Coombe, on the eastern side of Croydon. The subsoil

at Coombe is Thanet Sand, a bed of rock in which digging tunnels is easy. Tunnels in the same bed have been explored at Waddon, on the west side of Croydon, and also at Beddington, the next parish to the west. Indeed, your scribe, who lives around half a mile from Coombe, dug his own boy-sized cave in the Thanet Sand in his back garden at about the age of eight or nine: it fell in long ago! SOURCE: AUBREY, John [1626 – 1697], 1949, *Brief lives and other selected writings by John Aubrey*. Edited with an introduction by Anthony Powell. London: Cresset Press Ltd: xxv + 410pp (page 229)



# Eardington Canal Tunnel, Shropshire

Kelvin Lake



*Looking back towards the canal dock from about 30m into the canal tunnel*

Just south of Eardington near Bridgnorth in Shropshire is a small hamlet called Lower Forge. This is the site of a forge built in 1782 at the same time that a 750-yard-long canal was driven through the high sandstone ridge on the west side of the site to connect Eardington Upper Forge (built 1778 on the Mor Brook) to the River Severn. The Mor Brook powered the machinery at Upper Forge, but was unsuitable for navigation and it was half a mile from the River Severn; hence the decision to drive a canal

tunnel to connect the forge with the river.

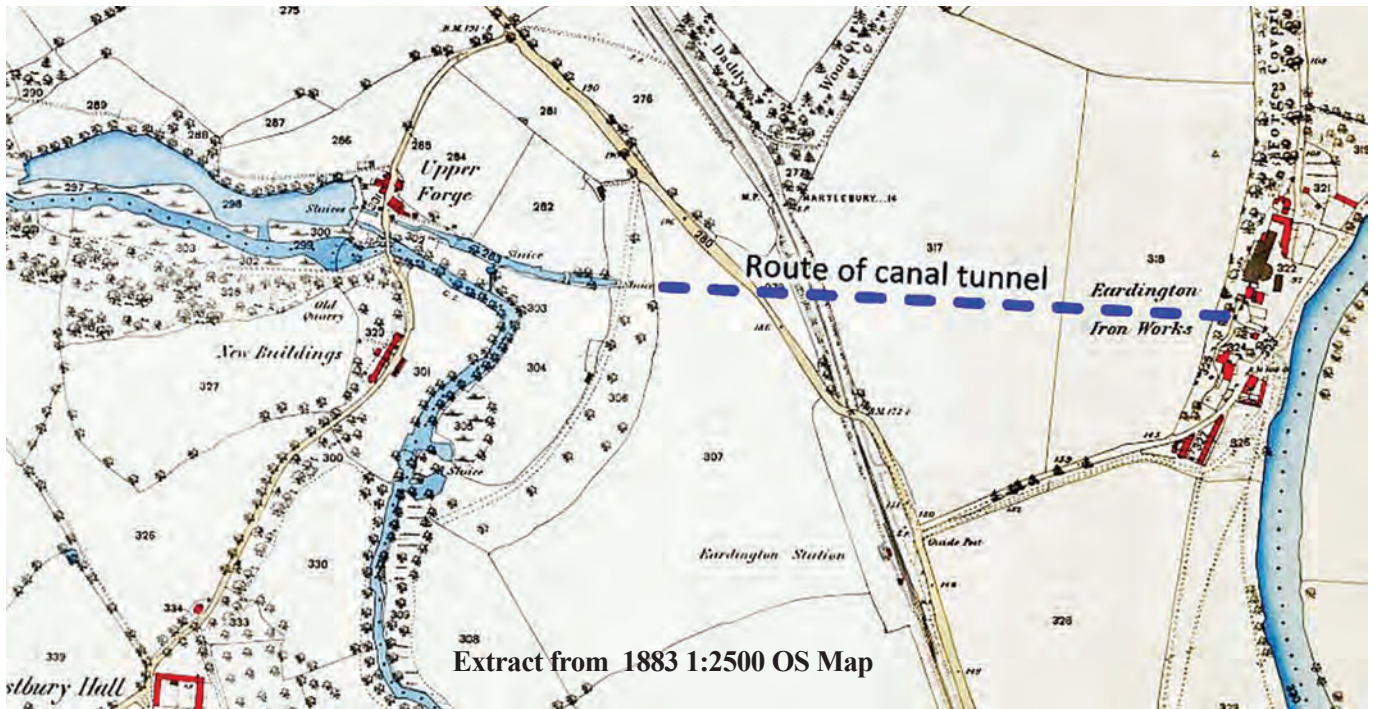
In addition to linking Upper Forge to the river, the canal also provided a water supply to power machinery at Lower Forge – where the tunnel ended in a dock area carved in the cliff face about ten metres above the level of the River Severn! In addition to the dock, a number of ‘caves’ and water channels were cut inside the cliff to serve the forge. These water channels fed a waterwheel (possibly two) and other parts of the forge site.



*Colin Lears, David Adams and Ken Lock preparing for the trip along the tunnel at Lower Forge, 13 Feb. 1966.  
Photo from SCMC archive*



*Colin Lears in the dinghy during the tunnel trip, 13 Feb. 1966. Photo from SCMC archive*

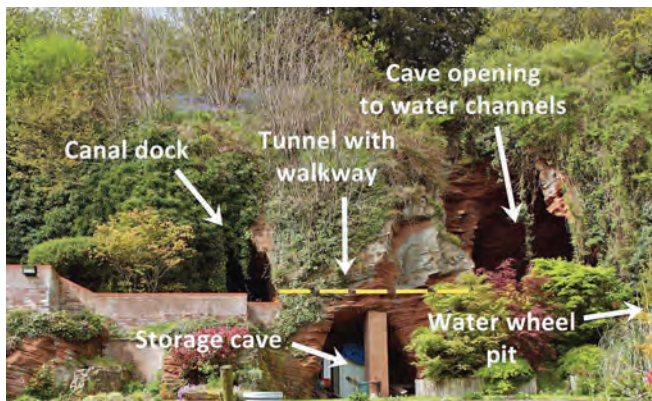


### Forging Ahead

On 13 February 1966 a group from the Shropshire Caving and Mining Club undertook a trip from the Lower Forge canal dock to the western tunnel portal at Upper Forge, using a pontoon and rubber dinghy. The 1966 trip proved successful and the tunnel was explored.

In December 2016 the Shropshire Caving and Mining Club managed to get permission to explore Lower Forge ironworks site – where a number of interesting culverts were discovered. They subsequently got permission from the landowners at both ends of the canal tunnel to revisit the sites. Thus a return trip was planned for 8 April 2017, to the Lower Forge canal portal and on 9 April to the Upper Forge site. Only 51 years between visits!

Club members arrived at Lower Forge and after a quick recce from the canal dock area decided that it should be possible to ‘walk’ through the tunnel. Although there was ample headroom in the water (see plan) and dock area



*The openings in the cliff face at Lower Forge, 8 April 2017.  
Photo Ian Cooper*

Things have changed a little bit at the Lower Forge canal dock. The dock has been filled in and paved to provide a storage area and a wooden walkway constructed along one of the side tunnels to provide safe access to other ‘caves’ in the cliff face. There is now only a trickle of water running through the tunnel (largely due to a dam and the construction of fish ponds at the Upper Forge site some years ago).



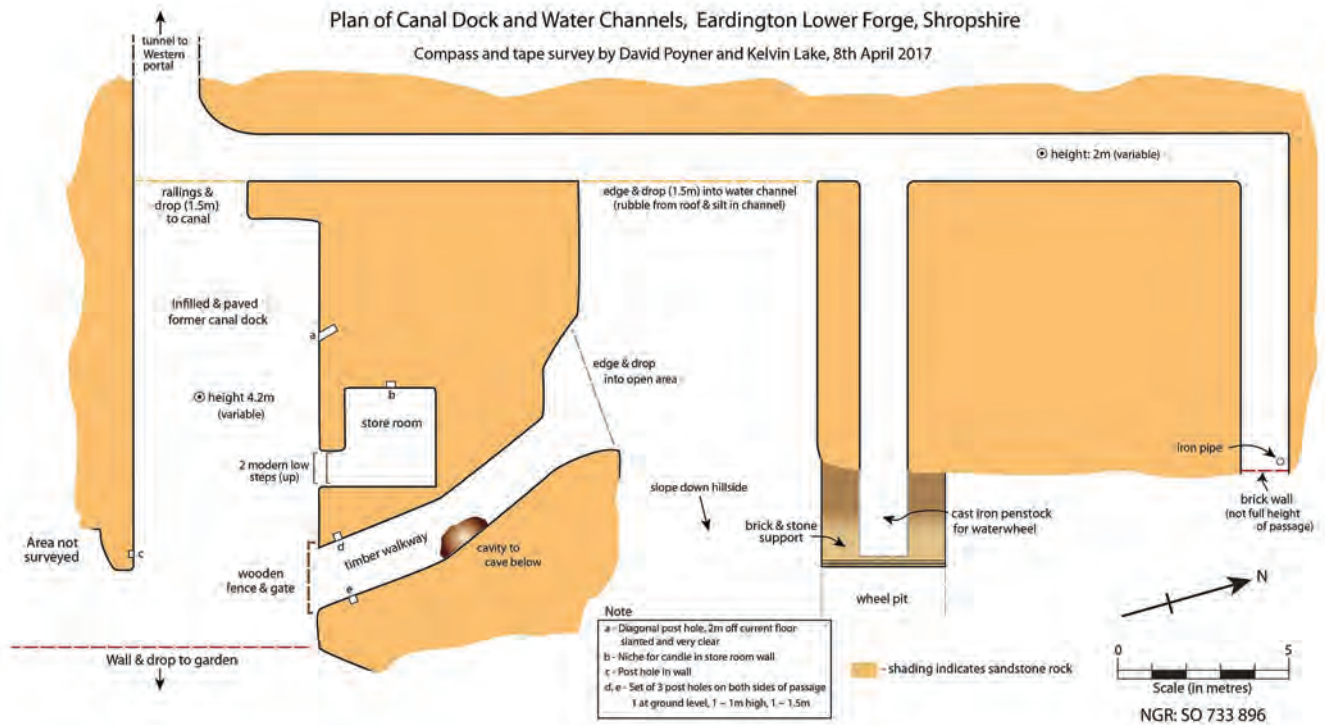
*Club members in the canal dock area.  
The railings beyond them mark the drop down into the canal and the main tunnel entrance*



*The present-day view out of the canal dock. The low wall marks the point where the pontoon was launched in 1966. The wooden fence is the entrance to the walkway to the next ‘cave’*

## Plan of Canal Dock and Water Channels, Eardington Lower Forge, Shropshire

Compass and tape survey by David Poyner and Kelvin Lake, 8th April 2017



the canal tunnel was quite low. This was probably due to a large amount of silt which has built up, with the trickle of water carving a channel effectively down the middle.

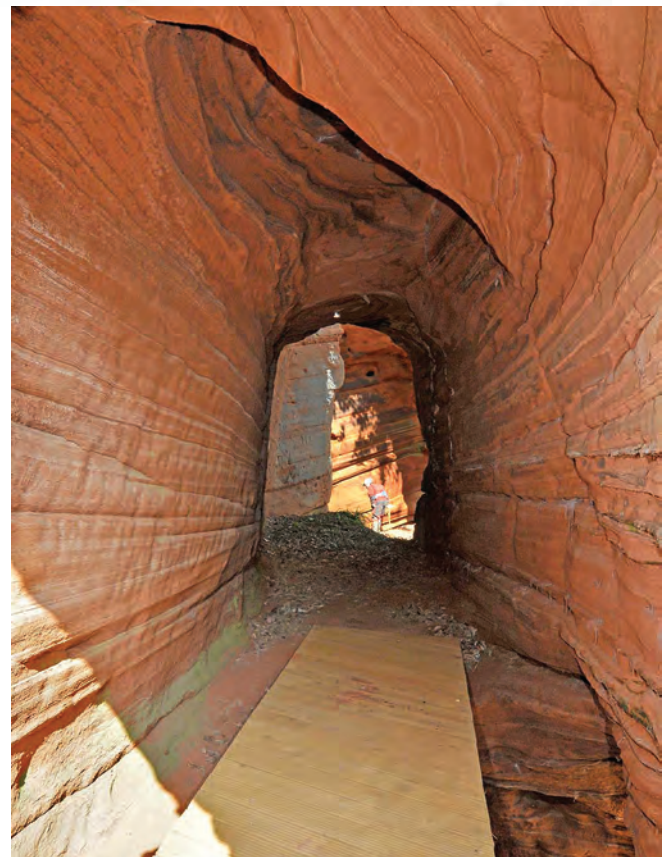


*The author looking into the main tunnel (only 750 yards to go ...!). The camera position is at the right-hand corner of the railings at the end of the canal dock area. Compare this view with that of the dinghy and pontoon in 1966. It shows how much higher 'ground' level is now. Photo Ian Cooper*

### Muddy Waters

To access the canal tunnel from the canal dock we went through a side passage with a timber walkway over a void into a storage cave into another open cave-like area. From this area it was possible to drop into the water channel behind the cliff face. Luckily we had brought a short step ladder to make access a little easier.

If you look at the 1966 photograph, even when in water there was not much headroom at the portal. On the more recent trip the silt in the canal was initially firm underfoot; however, it was soon found that if you stood still, you broke through the 'crust' and sank into very sticky mud and ran the risk of losing your wellies! The solution was



*View north from the canal dock along the walkway tunnel to adopt a sort of crouching position and 'run' as quickly as possible over the suspect spots!*

This water channel fed the ironworks waterwheel and possibly at one time a second wheel. The outfall for the penstock of the second wheel appears to have been bricked up and an iron pipe sunk into the floor near the end. As the pipe stands proud of the floor it would have maintained a head in the rest of the channel, with the pipe acting as an overflow.



There are other channels and iron pipes in the cliff face further along the ironworks site, so it is possible that this pipe led to them, although how they were constructed in the rock face is not clear today, as any possible access points are not currently visible.



*View along the tunnel leading to the waterwheel penstock. Note: the white marks indicating the historic water level, the muddy floor, and roof voids due to the spalling of the sandstone*



*The iron frame of the waterwheel penstock. Note how tree roots are coming through the sandstone*



*View from the junction to the waterwheel passage, along the main water channel to the access point, where the man is standing. A lot of the debris in the channels (and the canal tunnel) is due to spalling of the sandstone roof, mixed with silt. Again, note the historic water level marks*

### Tunnel Vision

The trek through the tunnel was, to say the least, strenuous. The combination of the gloopy mud, the need to move quickly, and the reduction in headroom towards the western end, wasn't to everyone's liking and some members of the party gave up, leaving four people to struggle on to the end. Three of them made the return trip through the tunnel but one decided that once was enough and returned to Lower Forge via the road – it did seem to be quicker than 'walking' through the tunnel.

From a crouched position by the canal dock portal a dot of light from the other end of the tunnel could just be seen in the distance; however, the tunnel was not perfectly straight. There were some surprising bends in the tunnel and a couple of wider sections near the Lower Forge end.



*Surprisingly the canal tunnel isn't perfectly straight and has some wider sections. Note the historic water level marks - not much headroom!*

The wider sections may have been due to spalling of material from the sides and roof. Any roof falls that were visible were covered in silt so had not occurred recently. Parts of the tunnel sides had been reinforced with brick, plus in a very wide section (about 300m from the Lower Forge dock) a brick pillar had been constructed to support the roof.



*Some sections of the tunnel wall have been reinforced with brick. Was this due to boat damage or just a soft patch of sandstone?*

There were no obvious construction shafts in the tunnel, so it is possible that it was driven from both ends and the very wide section was the point where the two headings met – but this is just speculation. The tunnel was generally 1.5 to 2 metres wide and the upper section fairly uniform in cross section. In this section there were a lot of bat droppings on one side. Beyond this area, heading west, a long wide



*Some distance into the tunnel is this very wide area. Was this a place where boats could pass, an erosion point, or where 2 headings met? There was evidence of material falling from the roof - but it was covered in silt and not fresh. Note: the speckles on the floor on the right are bat droppings*



*It was difficult to avoid sinking into the mud at the western end of the very wide section, where the roof has been reinforced with a brick pillar*

mud bank on the south side of tunnel was covered with hundreds of footprints, believed to be otter prints.

Near the western end of the tunnel the silt has built up to a point where progress is only possible by being bent

double (definitely not good for one's back). About fifty metres from the portal, to make good progress it becomes necessary to resort to a 'hands and knees' crawl. Although closer to the portal it is almost possible to stand up again.

### Canal Operation

It is not known exactly how the canal operated. The general consensus is that materials and products from Upper Forge were sent through the tunnel to the dock at Lower Forge, either for transhipment to boats on the River Severn or for use in the forges and furnaces there. The boats were propelled by the flow of water through the system. Simple enough, but

1. How were the boats controlled – did they 'crash' into the dock?
2. How were the empty boats returned to Upper Forge?



*View along the canal through the Upper Forge site towards the western portal of the canal and the sandstone ridge*

On Sunday 9 April the group visited the tunnel site at Eardington Upper Forge. Here the route of the canal east of the road and below the main furnace ponds was converted to a series of fish ponds a number of years ago. Although the canal is still in water a dam has been constructed near the tunnel portal raising the water level well above that of the tunnel.

The tunnel portal survives in a sandstone cutting with a number of holes and recesses cut into the sides. These holes (presumably) at one time supported large baulks of timber, suggesting there was once a substantial structure above the canal and portal at this point.

Interestingly the holes in the south side of the cutting, although similar in section, are twice the depth of those on the north side (0.53m deep rather than 0.22m). The eastern end of the cutting, directly above the tunnel also has some interesting features – again suggesting the existence of 'something' above it.

### Winding Mechanism

Accounts of the tunnel operations talk about boats being winched back to Upper Forge against the flow of the water. It is not unreasonable to suppose that the winching was done from a framework mounted on baulks of timber fixed in these holes.

The report of the Club trip in 1966 mentions seeing an iron winch or windlass at this end of the tunnel.





View east of the western portal of Eardington canal tunnel. Note the various holes and recesses in the cutting walls



The sluice gate - 1m wooden stick and cm square b/w scale



View just inside the western portal. This is spacious compared to a little further in! Photo Ian Cooper

Depending upon its size, could that have been used to wind the boats back through the tunnel? Or was it used for something else?

At the tunnel portal there are remnants of rendering on the north side (about 3cm thick). On the south side, there are the remains of a brick structure. Unfortunately this side of the cutting is obscured by a pile of spoil and debris which has fallen from above.

The tunnel portal is not centred in the cutting, so there may well have been something on the south side of the cutting which gave access to the portal and canal – hence the brick remnants visible under the debris.



Excavating the sluice gate

While studying the area around the portal a ‘small’ piece of iron and timber was spotted. Luckily the landowner was happy for us to have a little dig. Initially we thought it would be just a old fence post, however as digging continued we realised it was quite a substantial item made of thick timbers held together with long bolts and a metal sheet cover on parts.

We eventually uncovered enough to be fairly sure that it was a sluice gate about the same size as the portal mouth. So the 1966 windlass may have been mounted above the portal and used to raise and lower this gate.

### Tunnel Operation Hypotheses

If we consider the questions posed, these are some suggested answers:

1. If the boats were winched back through the tunnel, then they would have to take the hauling rope through the tunnel with them. So maybe their downstream progress was controlled by the haulage system mounted above the Upper Forge portal. Perhaps with a brake on the drum controlling them, in much the same way that gravity inclines worked.

Simple marks on the rope (eg. a rag tied to it) would indicate when the boat reached the dock area. This method would also mean that there would be no need for anyone to travel through the tunnel with the boats. This could explain the relatively low headroom.

2. A large capstan turned by hand could be used to haul the boats back. However, if the water was also supplying a waterwheel there would be quite a current through the tunnel. Possibly for the return trip the sluice gate was dropped to reduce the flow and make it easier to haul the boats back. If anyone has any other thoughts, please let me know.

Special thanks to the landowners at both end of the tunnel for allowing access to the forge and tunnel sites. Both landowners have made it clear that future permission to enter the tunnel or examine the area around the portals would not be granted.

**Editor’s note:** This feature is adapted from an article from the Shropshire Caving and Mining Club journal *Below*, published in October 2017.

All photos Kelvin Lake – IA Recordings unless stated.

# Cabinet War Rooms Museum visit, London

Bill and Joan Ridgeway



*CWR guide Lucy Tindle explains how the Map Room operated during the war, and some of the secrets behind the coloured phones*

On 25 October 2016, after an approach by ourselves, members of Subterranea Britannica were invited to the Cabinet War Rooms Museum by the Exhibition Manager. This included a private guided tour, followed by free time around the museum.

We were greeted by the Exhibition Manager and were taken to a side door and descended the steps into a side room where we were shown a short presentation film explaining why the World War Two bunker was built. If London were being bombed, it was realised that a direct hit on the Treasury building would completely eliminate the central government of the country.

The site was chosen because it was near to Buckingham Palace, Downing Street, Parliament and the offices of the main Departments of State. The first War Cabinet meeting in the underground Cabinet War Room took place on 21 October 1939. After the war the Cabinet War Rooms were maintained by the Ministry of Public Building and Works (MPBW) on a 'care and maintenance' basis until 1970 when the decision was made to create the Cabinet War Rooms Museum which itself was opened to the public in 1984.

The museum is set up as if it is 15 October 1940 – the day after Downing Street was hit by a bomb. Unlike members of the public, we were actually allowed into rooms and



*Cored hole through concrete-filled room under stairwell to allow postwar access around the complex. The wartime concrete was unreinforced but sufficiently hard to take the workmen many times longer to drill than they had planned*

behind the plate glass protective screens – it felt like being in a goldfish bowl. We were therefore able to get up close to, but strictly not to touch, the exhibits, making it easy to take photographs without the glare of the glass.

## **Cabinet Room**

Having passed an armed Marine Guard we entered the Cabinet Room. This was laid out as if ready for a meeting. Each of the eighteen places had an ash-tray, reminding

us how prevalent smoking was a couple of generations ago. The top layer of each blotter pad was removed and destroyed immediately after each meeting to avoid the leakage of any information. Two lamps (green and red) indicated whether or not an air raid was in progress, when a warning bell also sounded.



*Privileged access to the interior of the War Cabinet Room. The PM (at first Chamberlain and then Churchill) would have sat at the far end and would have been faced immediately by the three service heads who sat within the larger table. The large steel beam is from secondary strengthening works when there were concerns that the original basement design was not strong enough*

People in the bunker were shielded from noise and vibrations from the outside by air-tight rubber seals on the doors. Ventilation in the bunker consisted of air being blown into the bunker; there was no air extraction. This positive or over-pressure would have helped protect against possible gas attacks. Meetings could take two or three hours in which they discussed and agreed on 'Actions' and 'Conclusions'.

The personnel that would have been in the War Cabinet meeting on 15 October 1940 were:

Winston Churchill

To his right: Major-General Sir Hastings Ismay (Chief of Staff to the Minister of Defence and Deputy Secretary [Military] of the War Cabinet) and Sir Edward Bridges (Secretary to the War Cabinet)

To his left: Clement Atlee (Lord Privy Seal) and Sir John Anderson (Lord President of the Council)

Facing him: General Sir John Dill (Chief of General Imperial Staff), Marshal of the Royal Air Force Sir Cyril Newall (Chief of Air Staff) and Vice-Admiral TSV Phillips (Vice-Chief of Naval Staff)

Around the rest of the table: AV Alexander, Sir Archibald Sinclair, Sir John Reith, Air Marshal Sir Christopher Courtney, Lawrence Burgis, Ernest Bevin, Sir Kingsley Wood, Arthur Greenwood, Viscount Halifax, Lord Beaverbrook, Sir Alexander Cadogan, Alfred Duff Cooper, Sir Andrew Duncan, Viscount Cranborne, and Herbert Morrison (of air-raid-shelter fame).

## Map Room

The Map Room shows clearly how the Cabinet War Rooms were developed from an existing basement area. On the realisation that the existing basement would not have withstood a direct bomb hit, it was strengthened with wooden buttresses and footings; these created many trip hazards which would not be tolerated today!



*Inside the continuously manned Map Room where military staff produced daily summaries of the war for the King, the Prime Minister and the Chiefs of Staff. The maps in the Map Room are all heavily punctured by pins. Boxes of coloured pins and threads were used to plot movements*



*The map room in use in 1945. Reproduced under the terms and conditions of the IWM Non Commercial Licence*

Thick wood was used as it would creak and give warning under stress whereas metal would just fracture. Plus, of course, metal was in short supply with the large armaments programme under way. The Map Room is laid out as if it were a 'quiet day'.

The Map Room was headed by Wing Commander John Heagerty. Other people in the Map Room represented each of the armed forces and Home Security. The colour of the phones indicated their connectivity: ivory being a private wire to Downing Street, red connected to the Admiralty and the green phone was a scrambler. Another way of communicating within the bunker was by vacuum tubes (also referred to as Lamson tubes after the name of their manufacturer).

Occupants of the Map Room were referred to at the time as “the glory boys” and the phones along the middle of the Map Room were known as “the chorus line”.

### Churchill’s Bedroom and Study

Churchill slept in the War Rooms on only three occasions (as he preferred to sleep at either 10 Downing Street or the No.10 Annexe, a flat in the New Public Offices directly above the Cabinet War Rooms). It was in his study that Churchill prepared and made his speeches into microphones which were connected directly to the BBC for broadcast to the nation. Churchill made four wartime broadcasts from the Cabinet War Rooms. Beside his bed was a large bin – Churchill had a habit of tossing old cigars to one side and the provision of a large receptacle increased the chance they would land in a safe place.



*Churchill’s bedroom and study. Photo Bill Ridgeway*

There were several other bedrooms assigned to the upper echelons. It was noted that rank determined the size of the room allocated and facilities.

### Room 63

This is a small room (which most staff thought was a private toilet) in which Churchill could have a phone conversation with President Roosevelt. Only Churchill was allowed to use this room but he had to be accompanied by Ruth Ive whose job it was to ensure Churchill did not give away any secrets. She had the authority to terminate the call and was the final arbiter.

Calls were routed via SIGSALY, the terminal equipment for which, being so bulky, was in the basement of Selfridges. Churchill’s conversations were enciphered here and transmitted by cable to Scotland where a short-wave radio link bridged the Atlantic to President Roosevelt in Washington where there was a similar terminal in the Pentagon building.

### Support Rooms

A small typists’ room accommodated four typists (with their typewriters and a *Cyclostyle* duplicating machine). Another small room held a BBC Studio and accommodated a transmitter. A power room controlled the electrical supply to the War Rooms. This currently holds a mock-up of panels reinstalled in their original locations.



*BBC OBA/8 outside broadcast equipment with 4-channel mixer central, monitor loudspeaker above, and at the sides power supply, peak programme meters, line drive amplifiers and ancillary cueing and talkback equipment (and a field telephone on the left)*



*Power plant control panels. Photo Bill Ridgeway*

### ‘The Dock’

This level below the main floor provided a sub-basement which held services and additional sleeping accommodation. It was not full height across most of its area and many people preferred not to use it. One of the rooms is reputed to have been Churchill’s wine cellar.



*Steps down to “the Dock”, the sub-basement under the War Rooms where lower ranking staff would eat and sleep in cramped surroundings beside chemical toilets and scurrying rats*

Today, the sub-basement is a convenient place to hide cables and pipes. During the war, pumps were required to keep the area dry and pumps still have to be kept running permanently to prevent water ingress. One 60' length of corridor was, at some time, used as a rifle range; this remained in use until the 1960s. We were, unfortunately, not allowed access for operational reasons.

### The Churchill Museum

The guided tour was fascinating and as a result overran somewhat. Luckily there was still time to take a quick look at the Churchill Museum which has been opened recently in basement rooms adjoining the War Rooms themselves.

Thanks are due to the Exhibition Manager for a personal guided tour and access to areas not accessible to the public.

### Further information

[www.iwm.org.uk/visits/churchill-war-rooms](http://www.iwm.org.uk/visits/churchill-war-rooms)

[https://en.wikipedia.org/wiki/Churchill\\_War\\_Rooms](https://en.wikipedia.org/wiki/Churchill_War_Rooms)

[https://en.wikipedia.org/wiki/Churchill\\_war\\_ministry](https://en.wikipedia.org/wiki/Churchill_war_ministry)

[www.bbc.co.uk/london/content/articles/2008/09/01/ruth\\_ive\\_feature.shtml](http://www.bbc.co.uk/london/content/articles/2008/09/01/ruth_ive_feature.shtml)



*The kitchen in 1945; this is where Churchill's indispensable cook Mrs Landemare worked. She had been much in demand as a chef prior to the war, but offered her services to the Churchills for the duration of hostilities knowing how important keeping the great man well fed would be*

Photos by Chris Rayner unless stated

## Surface Walks with Paul Sowan

The typical visit to an underground site, probably for the majority of members, consists of arriving by car or coach, getting kitted up, and getting underground as quickly as possible. And quitting the site, to a pub or home, straight after exiting.

This is understandable of course if the visit is one of several during a day, as members may have travelled some way from home or even abroad to see as much as possible in the time available. However, to fully understand a site, a good walk around on the surface in the neighbourhood is usually just as important as what can be seen below ground. What are the geological, geographical, economic and historical contexts, for example.

Former secretary and chairman Paul Sowan has commenced a series of guided surface walks in and around Croydon and east Surrey to extend options for members, especially those who would like to understand underground places in 'greater depth' and gain some insight into how their archaeology and history are researched.

The first two walks were centred on the London Borough of Croydon, and on Merstham near Redhill in Surrey. The walks generally end at a carefully selected public house for those wishing to stay on for socialising. Reports of the first two walks follow.

### Surface walk at Croydon, March 2017

Seventeen members assembled at the Wandle Park tram stop on 19 March 2017 for a walk through Croydon led



*Merstham tunnel-surveying observatory tower*



by former chairman Paul Sowan. The objective was to appreciate the context of the several known underground sites in the town, almost all of them currently inaccessible. These included the culverted river Wandle, the remains of a medieval stone-vaulted undercroft in Surrey Street, the three tunnels of the former Woodside & South Croydon Railway, now used by Croydon trams, under Park Hill, the 1851 Croydon Board of Health's reservoir on Park Hill, deneholes (medieval chalk mines) at Coombe, and the very modern power cables tunnel which crosses the Borough east to west.

These sites reflect the underlying geology, from waterlogged gravels in Croydon's 'Old Town' to Thanet Sand and chalk, and also the depth below ground level of the local groundwater levels. The only underground option possible was a tram ride through the distinctly unusual Park Hill railway tunnels.

### Surface walk at Merstham, east Surrey, May 2017

East Surrey contains astonishingly extensive underground quarries, comprising a labyrinth of some miles of still accessible tunnels, which supplied building stone for ashlar and fine carved decorative work for London's most significant buildings, such as Westminster Abbey and the Tower, from the Norman Conquest through into the nineteenth century.

The Chaldon–Merstham quarries have been assessed by the English Heritage (now Historic England) *Monuments Protection Programme* as cultural assets of national importance, amongst the fourteen most highly rated historic quarry sites in England, eminently appropriate for Scheduled Ancient Monument status.

Associated with the quarries are well-preserved earthworks of the world's third public railway (the second railway authorised by Act of Parliament), the horse-operated Croydon, Merstham & Godstone Iron Railway which operated from 1805 to 1838, but was never built beyond a terminus at the underground quarries at Merstham.

The first mainline railway tunnel at Merstham, over a mile long, made in the years 1838 to 1841, is also of exceptional historic interest on account of its tunnel-



*The grave of Henry Hoof*

surveying observatory tower, a rare survival, and the contractors' problems with groundwater whilst driving it. On 27 May 2017 some three members assembled at Merstham station for a surface walk led by Paul Sowan, who has been researching the area for the last forty years or so. The thundery showers suggested as a possibility by that morning's weather forecast may have accounted for the small attendance, but did not occur.

The sites visited during the course of just over three miles included entrances to the underground quarries, earthworks and a bridge created for the horse-operated railway, historic road realignments, and Merstham Church (built of stone from the quarries) with the grave of Henry Hoof, one of the contractors who worked on the mainline railway tunnel.

It was explained that there are persistent 'urban myths', if not deliberately 'faked' history, still circulating concerning the quarries and the railway tunnel. And that a wide variety of primary sources, especially archived documents such as early nineteenth-century estate papers, railway civil engineering records, and geological and well records, through to 1970s motorway site investigation reports, needed to be consulted to understand the history of the sites visited. Few if any of these primary sources are to be found on the internet.

### Further down the line

Details of future walks will be announced in due course.

## Subterranea Britannica featured in Punch in 1987

Malcolm Tadd, when our Secretary, had notable successes in getting Subterranea Britannica featured in national magazines and newspapers. The 8 April 1987 edition of *Punch*, for example, carried a report from journalist Jonathan Sale on his attending one of our day conferences held at the Royal School of Mines.

Amongst the lectures on that occasion was one by Rod Le Gear on 'Underground Kent', and another by Roger Morgan on 'Underground London'. Both have continued their work and now have substantial bodies of published research to their credit. Rod is still an active member of the Kent Archaeological Society and the Kent Underground Research Group, and has specialised

in the archaeology of deneholes and chalk mines. Roger's study of the engineer Thomas Webster Rammel and his 'pneumatic' trains moved along tunnels by air pressure was published in the definitive and prestigious *Biographical dictionary of civil engineers* issued by the Institution of Civil Engineers.

'As a society', Malcolm was reported as saying, 'we have never had an accident', which is still true after 43 years of organising subterranean visits at home and abroad. He stressed the importance of the 'academic status' of underground studies.

SOURCE: SALE, Jonathan, 1987, Subterranean homesick blues. *Punch*, 8 April 1987, 21 – 22.



## Discounted Cotswold Shopping

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If you are not able to access the website, then please contact us with an SAE for a copy of the letter.

The discount code can be used in any of their 58 stores (there is a barcode on the letter), and for telephone and online orders.

*\*\*\* Please do not share or abuse the code as this may lead Cotswold to withdraw it which would be a great shame and spoil things for the rest of our members. \*\*\**

Here is an introduction from David Hague of Cotswold:

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